BIBLIOGRAPHY OF INVESTMENT AND OPERATING COSTS FOR CHEMICAL AND PETROLEUM PLANTS JANUARY–DECEMBER 1959

By Sidney Katell, John H. Faber, and John W. Douglas

* * * * * * * * * * * information circular 7966

UNITED STATES DEPARTMENT OF THE INTERIOR
Fred A. Seaton, Secretary

BUREAU OF MINES
Marling J. Ankeny, Director

IE WORK UPON WHICH THIS REPORT IS BASED WAS DONE UNDER A COOPERATIVE AGREEMENT BETWEEN THE BUREAU OF MINES, U.S. DEPARTMENT OF THE INTERIOR, AND THE AMERICAN ASSOCIATION OF COST ENGINEERS.

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BIBLIOGRAPHY OF INVESTMENT AND OPERATING COSTS

FOR CHEMICAL AND PETROLEUM PLANTS

JANUARY - DECEMBER 1959[1/]

by

Sidney Katell[2/], John H. Faber[3/], and John W. Douglas[4/]

INTRODUCTION

Continuing the series of cost bibliographies which was initiated with the publication of Information Circular 7516 in October 1949, the present report covers the period from January 1959 through December 1959. The abstracted articles, concerned with all facets of cost engineering in the field of petroleum and chemical plants and related facilities, were obtained from the following sources:

1. Bureau of Mines Information Circulars.
2. Bureau of Mines Report of Investigations.
3. Chemical Engineering.
4. Chemical Engineering Progress.
5. Chemical Week.
6. Coal Age.
7. Coal Utilization.
8. Cost Engineering.
9. Industrial and Engineering Chemistry.
10. Nucleonics.
11. Oil and Gas Journal.
12. Petroleum Engineering.
13. Petroleum Refiner.
14. World Oil.

On Oct. 16, 1959 a cooperative agreement between the Bureau of Mines andthe American Association of Cost Engineers became effective. This agreement provides for the publication of the annual bibliography under the sponsorship of both groups with the work load involved in the preparation divided equally between the two. As a result, the present report partially reflects the efforts of the members of the Association.

1/ Work on manuscript completed February 1960.

2/ Chief, Process Economics Evaluation Staff, Bureau of Mines, Region V, Morgantown, W. Va.

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The Bureau's report still remains as the only one of the abstract type of bibliography. As noted in Items 64 and 262, other groups have continued their work, but they are more limited in scope. There remains a certain amount of overlap in the various bibliographies, yet they all serve a useful purpose.

It is impossible to pick out for special mention the most important articles which appear each year, but the following are of interest in that they deal with important current and future problem areas.

1. A series of articles dealing with air cooling have been published--Items 145, 154, 155, 167, 189, 192, 193, 225, 252, and 253.

2. The use of computers in cost engineering is newsworthy--Items 83, 87, and 143.

3. Our changing economy is reflected in the cost indexes--Items 40 and 158.

4. Nuclear explosives to develop a new source of petroleum may eventually be developed--Items 3, 169, and 170.

5. Air pollution control is a major issue in many areas--Items 11, 41, 86, and 105.

Several of the articles which were abstracted and included in the bibliography cannot be clearly defined as cost items. However, they contain information of value to the cost engineer. For example, Items 9, 18, 19, 56, 221, 222, and 236 describe cost accounting methods which can be used in determining both capital and operating costs. Items 109, 110, and 266 describe the effects of inflation on depreciation rates. Profitability is the end product of any venture; its application is discussed in Items 112, 261, and 264.

ABSTRACTS

A

1. ADAMS, ERNESTINE. More Deep Holes At Less Cost. Petrol. Eng., vol. 31, No. 3, March 1959, pp. B-19 - B-29.

Drilling costs dropped more than $50,000 per deep well in 1958 after an all-time high in 1957 of nearly three quarters of a million. Average cost per well in 1958 was $692,000, slightly more than $43 a foot.

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2. ALLISON, ROBERT J. The Dravo Dyna-Cone Vacuum Dryer. Cost Eng., vol. 4, No. 2, April 1959, pp. 19-23.

Special item of equipment for drying solids; costs of basic unit shown, added costs estimated. No installation mentioned.

3. ANDERSON, CARL C. Underground Nuclear Explosions: Awesome Recovery Promise. Petrol. Eng., vol. 31, No. 9, August 1959, pp. B-28 - B-31.

"Operation Plowshare" is government's atomic energy program that is applicable to petroleum industry. Program is designed to encourage use of nuclear explosions for peaceful purposes. Breaking and heating of oil-bearing rocks in petroleum reservoirs and tar sand deposits, and fracturing of oil shale to prepare it for either mining or thermal recovery by in situ combustion process are of prime interest to petroleum industry from this program. Cost estimates for producing shale oil by this method are included.

4. APITZ, C. R. Gas Turbine Applications in Gasoline Plants. Petrol. Eng., vol. 31, No. 5, May 1959, pp. C20, C22, C23, C25-C27.

Evaluates turbine design. Actual installation costs can be expected to be as follows: (1) Gas turbine-driven generator plants constructed on complete turnkey plant basis for $175 to $190 per kilowatt; (2) gas turbine-driven centrifugal compressor units will vary from $130 to $180 per horsepower; and (3) gas turbine-driven centrifugal pump units established between $130 and $150 per horsepower.

5. ARGINTAR, HERBERT, AND O'DONNELL, JAMES P. Energy for Process Industries. Chem. Eng., vol. 66, No. 14, July 13, 1959, pp. 131-142.

Many factors influence selection of energy source for process industries. They are: (1) Fundamental needs of the plant; (2) plant location; (3) availability of energy sources; (4) overall plant operation; (5) methods of energy conversion; and (6) cost and type of use of each source. Discusses these factors in general, presents useful data, and develops an illustrative example for study. Cost information is presented throughout.

6. ARIES, ROBERT S. New Additive Now Gives High Octanes at Low Cost. Petrol. Refiner, vol. 38, No. 7, July 1959, pp. 159-160.

Tertiary butyl acetate effectively increases gasoline octane ratings at low cost. Tentative design and economic study indicate that tertiary butyl acetate can be made in large commercial quantities for about 10 cents per pound--72 cents per gallon. Optimum usage of additive is about 0.7 percent volume. Thus, using additive will increase cost of gasoline by about 0.4 cent per gallon of gasoline.

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7. ARNE, FRANCES. Foamed Aluminum, New Structural Material. Chem. Eng., vol. 66, No. 21, Oct. 19, 1959, pp. 120, 122.

Estimated cost for insulating 3-inch thick deck structure of concrete, wood, steel, etc. with foamed aluminum is $1.34 per square foot. The overall coefficient of heat transfer for this new structural material is 0.19. Compared with many common structural materials foamed aluminum offers better insulating and acoustical properties at lower costs.

8. _____. Polyurethane Coating. Chem. Eng., vol. 66, No. 22, Nov. 2, 1959, p. 44.

Old shingles are being coated with polyurethane liquid resin, then sprinkled with ordinary sand, at approximate cost of material and labor at 50-60 cents per square foot. Process gives shingles many more years of water-proof service.

B

9. BAKER, WILLIAM J. Optimum ΔP Cuts Exchanger Costs. Petrol. Refiner, vol. 38, No. 7, July 1959, pp. 129-130.

Method presented for determining the optimum pressure drop in a heat exchanger to give lowest capital investment and most favorable operating costs.

10. BAKEWELL, A. A., JR. Mining Methods and Costs, Baguio Gold Mine, Baguio Gold Mining Co., Baguio, Luzon, Philippine Islands. Bureau of Mines Inf. Circ. 7903, 1959, 47 pp.

Describes mining methods and practices at Baguio Gold Mining Co., Philippine Islands. Tables included giving data on performance and costs of mining and milling, consumption of supplies, and general operating statistics.

11. BALLMAN, HARRY C. Economic Aspects of Air Pollution. Coal Utilization, vol. 13, No. 12, December 1959, pp. 35-36.

Sulfur dioxide is becoming a collectable pollutant in country's fight against air pollution caused by fuel burning. A SO_2 removal device for reducing this effluent to atmosphere will cost $4 to $6 per ton of coal fired or equivalent per gallon of oil fired, increasing basic fuel cost 50 to 60 percent.

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12. BANKS, WILLIAM S. The Future of Gas-Cooled Reactors. Nucleonics, vol. 17, No. 9, September 1959, pp. 96-102.

Economic comparison between coal-burning heat source and gas-cooled reactor heat source. For gas reactor to compete with coal it would have to do the following:

1. Fuel elements that can run at 2,000° F., deliver gas at temperatures above 1,500° F., and survive to burnups beyond 15,000 megawatt-days per metric ton.
2. Fuel costs in neighborhood of 2 mills per kilowatt-hour.
3. Plant size in range of 1,100-1,500 megawatts (th).

Estimated cost of gas reactor is about $70 per kilowatt for reactor complex if incremental power cost were 1 mill per kilowatt-hour cheaper than coal, or at about $100 per kilowatt for 2 mills per kilowatt-hour advantage. Detailed cost comparison of two sources are included.

13. BARKER, JOHN W. 'Ain Dar Gas-Injection Project. Petrol. Eng., vol. 31, No. 4, April 1959, pp. B-36 - B-38.

Gas-injection plant proper in Ghawar field of Saudia Arabia including power generating facilities will cost approximately $17,000,000. Gas-gathering lines, injection lines, gas-oil separator plant conversions, power transmission lines and other miscellaneous off-plant work will cost $13,000,000.

14. BASCOM, WILLARD. Operation Mohole. Petrol. Eng., vol. 31, No. 9, August 1959, pp. B-24 - B-27.

Discusses planned project for drilling through oceanic crust to obtain samples of mantle at depth of about 30,000 feet. Project sponsored by AMSOC (American Miscellaneous Society) is called Mohole. Total cost of preliminary tests, equipment, and actual drilling is estimated at $15,000,000.

15. BAUMAN, H. CARL. Capital Cost Control. Ind. Eng. Chem., vol. 51, No. 5, May 1959, pp. 69A-71A.

Describes procedures for controlling costs within capital estimate. Cost of cost control varies between 0.2 and 1.0 percent of total project value.

16. _____. Costing Piping, the Bugaboo of Chemical Plant Estimating. Ind. Eng. Chem., vol. 51, No. 1, January 1959, pp. 81A-83A.

Shows new method for estimating piping costs from flowsheets. Piping costs vary from 30 to 80 percent of process equipment value or from 4 to 15 percent of installed plant cost. Estimation of process plant piping presents greatest challenge to cost engineer.

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17. BAUMAN, H. CARL. How Much for Electrical Installation? Ind. Eng. Chem., vol. 51, No. 3, March 1959, Part 1, pp. 67A-69A.

Accurate estimates of electrical installation costs can be made by 3 methods: (1) Detailed take-off; (2) factored electrical cost as percent of plant total installed cost for specific types of plants; and (3) unit costing. Cost tables are included backing these estimating methods.

18. _____. Measuring Significant Cost Elements. Ind. Eng. Chem., vol. 51, No. 11, November 1959, pp. 63A-66A.

Construction cost control; examples of records needed to hold jobs within estimates.

19. _____. Mechanics of Project Cost Control. Ind. Eng. Chem., vol. 51, No. 7, July 1959, pp. 67A-69A.

More details on how to keep construction costs current as the plant is built, to avoid deviation from estimate.

20. BEBBINGTON, WILLIAM P., AND THAYER, VICTOR R. Production of Heavy Water. Chem. Eng. Prog., vol. 55, No. 9, September 1959, pp. 70-78.

Presents engineering details for heavy water production by dual temperature exchange using hydrogen sulfide, known as GS process. Both Dana and Savannah River heavy water plants use this GS process. For cost analysis, Savannah plant is best. Investment and operating costs as well as production costs for this Savannah heavy water plant are included.

21. BEECHER, NORMAN, AND BENEDICT, MANSON. Which for Minimum Fuel Cost--Zircaloy or Stainless Clad? Nucleonics, vol. 17, No. 7, July 1959, pp. 64-67, 100.

Comparison of fuel costs with stainless-steel and Zircaloy-2 cladding for equivalent burnup recently announced by A.E.C. show that Zircaloy-2 cladding would give lower total fuel cost for burnups above about 12,000 megawatt-days per ton.

22. BIKE, PETER B. Active Fields Drilling Report. Oil Gas Jour., vol. 57, No. 42, Oct. 12, 1959, pp. 133-170.

Presents data for 150 old and new oil drilling wells as surveyed by Oil and Gas Journal to determine overall costs, rig-time, distribution, casing, mud programs, and average formation depths. Drilling costs range from $2,500 to $4,000. Completed well costs between $5,500 and $10,000.

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23. BLEAKLEY, W. B. "Soda Pop" Flood Scores High. Oil Gas Jour., vol. 57, No. 27, June 29, 1959, pp. 80-81.

Estimated cost of injecting carbon dioxide along with water in secondary-recovery project is $1\frac{1}{2}$ cents per barrel of water. Additional cost of CO_2 has been placed at 0.5 cent per barrel of water injected for 240-acre fizz-water flood of Oil Recovery Corp. in Washington County, Oklahoma.

24. BRADBURY, WILLIAM. TVA-Coal Power. Coal Utilization, vol. 13, No. 3, March 1959, pp. 18-26.

Discusses Tennessee Valley Authority's sources and costs of coal, cost of coal handling, and use for power operations in general, and plant operations in particular.

25. BRADLEY, W. E., HENDRICKS, G. W., HUFFMAN, H. C., AND KELLEY, A. E. Hydrogenation--Here Today and Here Tomorrow. Oil Gas Jour., vol. 57, No. 24, June 8, 1959, pp. 194-198.

Refining hydrogenation capacity for all stocks will continue to increase using hydrogen made available by reforming processes. For refining hydrogenation of various distillate stocks, quoted investment costs range from $75 to $200 daily per barrel of capacity.

26. BRAY, B. G., CARSTENS, R. A., MARTIN, J. J., AND THOMAS, L. D. Look at Radiation Ethylene Processing. Petrol. Refiner, vol. 38, No. 9, September 1959, pp. 255-260.

Presents design of radiation chemical processing plant to produce polyethylene. Comparative figures on estimated costs of polyethylene produced by radiation and conventional processes are included.

27. BROWN, K. M., GLIEM, W. K. T., AND URBAN, P. Low-Cost Way to Treat High-Mercaptan Gasoline. Oil Gas Jour., vol. 57, No. 44, Oct. 26, 1959, pp. 73-78.

Universal Oil Products' Merox process has developed low-cost process for treating high-mercaptan gasoline. This process extracts easily removed mercaptans and converts remaining mercaptans to disulfides. Chemical costs for Merox treatment are included.

28. BRUNDAGE, HARRISON T. Increase Aerial Survey Accuracy in Remote Areas. World Oil, vol. 148, No. 7, June 1959, pp. 136-137, 147.

Radar Doppler guidance surveys providing accurate navigation to guide photographic, photogeologic, and magnetic surveys from the air cost from $1 to $2 per line mile. Method has no necessary ground controls.

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29. BURCH, ROBERT L. The Paradox Gamble--Will It Pay Off? Petrol. Eng., vol. 31, No. 5, May 1959, pp. B-29 - B-34.

Cost study for Paradox Basin of Four Corners region (Arizona, New Mexico, Colorado, and Utah) is divided into four time periods: 1908-1920; 1920-1940; 1940-1950; and 1950-Jan. 1, 1958. Each period is treated for capital expenditures appropriate to an overall picture of economic status of Paradox Basin.

30. BURK, H. S., AND THIBODEAUX, I. E. Complete Byproducts Processing. Oil Gas Jour., vol. 57, No. 10, Mar. 2, 1959, pp. 91-93.

New plant facilities which came on stream during 1958. These integrated units and their costs are as follows:

Plant	Initial Capacity	Ultimate Capacity	Cost (including off-site facilities)
Ethylene (PCI)	200,000,000 lb./yr.	300,000,000 lb./yr.	$22,500,000
Ammonia (PIC)	100,000 tons/yr.	---	13,250,000
Ethylene oxide	57,000,000 lb./yr. [1/]	---	10,000,000

1/ Or 8,000,000 gal./yr. ethylene glycol

31. BURKETT, W. J. Minimeter for High Pressure. Chem. Eng., vol. 66, No. 22, Nov. 2, 1959, p. 106.

Minimeter for measuring small flows (cc's/min.) at high pressures has been solved by using laboratory glass rotameter inserted inside high pressure gage. Rotameter costs about $35 and glass about $75.

C

32. CANNON, D. R. Epoxies: A Boom at Last? Chem. Eng., vol. 66, No. 23, Nov. 16, 1959, pp. 112-114.

A recent 220-page report by Harvard Business School students predicts epoxy prices will drop 5-6 cents per pound by 1963 (60 cents per pound liquid resin, 50 cents per pound solid resin). Fully integrated producers will get an after-tax return of 15-20 percent on investment; non-integrated producers, less than 10 percent. Ultimate price--about 42 cents per pound.

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33. CARLSON, ROLAND H. Constructing Underground Storage Facilities With Nuclear Explosions. Petrol. Eng., vol. 31, No. 9, August 1959, pp. B-32 - B-34.

Discusses use of nuclear explosives in construction of underground oil and gas storage tanks. Cost of storing propane and butane in nuclear-mined caverns is between $2.80 and $5.40 per barrel. Construction costs of above-ground and underground storage facilities are shown. Also includes cost comparison of conventional and nuclear construction of 7 million barrels underground storage cavity.

34. _____. Constructing Underground Storage Facilities With Nuclear Explosions. Petrol. Eng., vol. 31, No. 11, October 1959, pp. D-19-D-21.

Contains essentially same information as Abstract 33.

35. CARSON, D. B., AND BROUGHTON, D. B. New Processes Remove N-Paraffins...2. - The Molex Process. Petrol. Refiner, vol. 38, No. 4, April 1959, pp. 130-134.

Cost data for removal of normal paraffins from gasoline is given. UOP's (Universal Oil Products) Molex process improves octane ratings of gasoline by removing inferior straight-chain aliphatic hydrocarbons.

36. CHEMICAL ENGINEERING. Aluminum Pipeline Costs Near Steel. Vol. 66, No. 22, Nov. 2, 1959, p. 122.

Cheaper pipe and a new welding technique bring the cost of buried aluminum pipelines to within 4 percent of less resistant coated-and-wrapped steel installations, even in marshy, salt-water containing soil.

37. _____. CE Cost File.

Presents both a series of graphs relating the size of chemical plant equipment to the cost of the particular equipment item and the labor factors for various unit installations.

Ref.No.	Vol.	No.	Date	Page	Item
37-1	66	2	Jan. 26, 1959	116	Heat exchanger cost estimation
37-2	66	3	Feb. 9, 1959	128	Piping insulation costs
37-3	66	7	Apr. 6, 1959	146	Piping and equipment insulation
37-4	66	13	June 29, 1959	112	Plate heat exchanger costs
37-5	66	19	Sept. 21, 1959	164	Electric motor costs
37-6	66	20	Oct. 5, 1959	155-156	Vibrating screen costs
37-7	66	21	Oct. 19, 1959	204	Labor Factors; Carpentry
37-8	66	22	Nov. 2, 1959	100	Labor Factors; Structural Steel
37-9	66	23	Nov. 16, 1959	200	Labor Factors; Electrical Circuits
37-10	66	24	Nov. 30, 1959	87-88	Labor Factors; Instrumentation
37-11	66	25	Dec. 14, 1959	174	Labor Factors; Painting
37-12	66	26	Dec. 28, 1959	86	Labor Factors; Pipe Insulation

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38. CHEMICAL ENGINEERING. Continuous Recovery Boosts Tall Oil Profits. Vol. 66, No. 5, Mar. 9, 1959, pp. 84, 86.

A continuous oil recovery system results in high recovery, better product, lower cost. System consists of hydrolysis of resin and fatty acid soaps skimmed from kraft-process black liquor. Capital investment cost for this 5,000 pound-per-hour plant will run $150,000-$200,000, including building and tankage.

If plant uses fresh acid, operating cost runs about $6.10 per ton of tall oil. When waste sulfuric acid from manufacture of chlorine dioxide bleach is used, operating costs drop to $1.33-$1.85 per ton of tall oil. Thus, most installations are designed to convert to waste acid.

39. _____. Costs Continue to Surge Upward. Vol. 66, No. 4, Feb. 23, 1959, pp. 149-150.

Contains Marshall and Stevens' 47-industry average of equipment cost indexes, and annual average indexes of comparative equipment cost for 8 process industries and 4 related industries which are chronologically tabulated from 1913 through 1958.

40. _____. Equipment Cost Indexes.

These indexes are compiled quarterly by Marshall and Stevens, Inc., but the indexes are listed monthly. The monthly references are as follows:

Ref. No.	Vol.	No.	Date	Page
40-1	66	1	Jan. 12, 1959	178
40-2	66	2	Jan. 26, 1959	150
40-3	66	4	Feb. 23, 1959	149-150
40-4	66	5	Mar. 9, 1959	199
40-5	66	6	Mar. 23, 1959	218
40-6	66	8	Apr. 26, 1959	224
40-7	66	9	May 4, 1959	183
40-8	66	10	May 18, 1959	234
40-9	66	11	June 1, 1959	158
40-10	66	12	June 15, 1959	239
40-11	66	13	June 29, 1959	149
40-12	66	14	July 13, 1959	206
40-13	66	15	July 27, 1959	174
40-14	66	16	Aug. 10, 1959	186
40-15	66	17	Aug. 24, 1959	181
40-16	66	20	Oct. 5, 1959	205
40-17	66	21	Oct. 19, 1959	251
40-18	66	22	Nov. 2, 1959	135
40-19	66	23	Nov. 16, 1959	239
40-20	66	24	Nov. 30, 1959	136
40-21	66	25	Dec. 14, 1959	219
40-22	66	26	Dec. 28, 1959	128

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41. CHEMICAL ENGINEERING. How to Cope With Air Pollution. Chem. Eng., vol. 66, No. 16, Aug. 10, 1959, pp. 113-124.

Investment and operating cost given for sulfur recovery unit using diethanolamine.

42. _____. Isocracking Bids for the Gasoline Pool. Vol. 66, No. 23, Nov. 16, 1959, pp. 106, 108.

New hydrocracking process, Isocracking, combines new catalyst, and this low-temperature operation upgrades refractory middle distillates (heavy cracked naptha, light catalytic cycle oil), yielding over 100 percent by volume of valuable gasoline components such as isoparaffins, toluene, and xylenes.

43. _____. New Alloy More Resistant Than Pure Titanium. Vol. 66, No. 10, May 18, 1959, p. 200.

New titanium with 0.1 percent of noble metal (palladium) is much more of "wonder" metal for corrosive service than pure titanium. Palladium costs about $19 per troy ounce.

44. _____. New Process Now Treats High-Mercaptan Stocks. Vol. 66, No. 24, Nov. 30, 1959, p. 28.

Universal Oil Products has developed new, commercially-tested process to caustic-treat broad range of mercaptan-containing stocks, either by mercaptan removal or sweetening (conversion of mercaptans to disulfides which remain in oil stock), or both. Trademame of process is Merox. Cost of Merox sweetening of gasoline or No. 2 fuel oil is less than 1 cent per barrel.

45. CHEMICAL WEEK. Betting Long Odds on Short-Cycle Citric Acid Route. Vol. 85, No. 23, Dec. 5, 1959, pp. 36-38.

Bzura Chemical's $2.5 million plant to go on stream March 1. Capacity estimated at better than 17 million pounds per year. Uses special chemical treatment of the mould for short cycles. Process can use very low cost sugars. No operating cost data except reference to Miles Chemical's use of high-test molasses at $0.03 per pound, plus deionization costs of $0.01 per pound.

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46. CHEMICAL WEEK. Morgantown: Worth a Second Look? Vol. 85, No. 20, Nov. 14, 1959, pp. 119-120, 122, 125.

Points out advantages of revamping Morgantown Ordnance Works (original cost $64 million) for NH_3 and methanol production. Revamping costs of $22 million required. Plant capable of producing up to 700 tons per day of ammonia at $40 per ton. Changing product mix could produce 400 ton-per-day methanol and 175 ton-per-day ammonia. Recommended product mix of ammonium nitrate and urea (solids and solutions) is given.

47. _____. New Citric Challenger. Vol. 85, No. 9, Aug. 29, 1959, p. 41.

Formation of Bzura Chemical Co. is announced. They will use new process to produce citric acid by fermentation of molasses. Market, capacity, and investment data given.

48. _____. New Octane Booster Brings Down By-Products. Vol. 85, No. 17, Oct. 24, 1959, pp. 39-40, 42.

Investment, operating costs, and payout time for new process by Standard Oil of California to upgrade refinery stream. With new catalyst, process operates at lower temperatures (400-700° F.) and produces high octane gasoline.

49. _____. Nuclear Power Plants. Vol. 85, No. 15, Oct. 10, 1959, p. 73.

AEC and Westinghouse estimate nuclear heat costs. Investment and operating cost data for nuclear reactors as a source of process heat. Expect nuclear reactors to be competitive with coal in some areas.

50. _____. Squeezing Speed From the Filtration Curve. Vol. 85, No. 18, Oct. 31, 1959, pp. 79-80, 82, 85.

New filter is being marketed which utilizes a rapid discharge of the cake at frequent intervals to gain a high overall flow rate. Investment, and some operating data, is included.

51. CHILDERS, R. O. Drilling for Oil in 1975. Petrol. Eng., vol. 31, No. 4, April 1959, pp. B-19 - B-24.

Cost of inspection of tubular goods for use on high pressure 15,000-foot hole, excluding handling charges and delay, is approximately $11,500. Gives estimated cost of completed rig in 1975.

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52. CHILTON, C. H. Chementator. Industry Shares in Water Desalting. Chem. Eng., vol. 66, No. 16, Aug. 10, 1959, p. 58.

Government plant at Freeport, Texas to produce 1 million gallons per day of water having less than 500 p.p.m. salinity for about $1 per 1,000 gallons. Plant, which uses W. L. Badger & Co. long-tube vertical evaporator will cost about $2 million.

53. _____. Chementator. Low-Temperature Isomerization. Chem. Eng., vol. 66, No. 12, June 15, 1959, p. 71.

Unit to isomerize low octane naphthas at low temperatures has been developed by Esso. A 5,000 barrel-per-day unit would cost $2 million; a 17,000 barrel-per-day unit would cost $3.25 million.

54. _____. Chementator. New Hope for Chlorine From HCl. Chem. Eng., vol. 66, No. 11, June 1, 1959, p. 33.

Cost of electrolytic regeneration of Cl_2 from by-product HCl. Investment for a plant to recover 20 tons per day of Cl_2 is $400,000; recovery cost is $36 per ton. Process data given.

55. CHRISTIANSEN, CARL R., CALHOUN, WILLIS A., AND BROWN, WALTER F. Mining and Milling Methods and Costs at the Indian Creek Mine, St. Joseph Lead Co., Washington County, Mo., Bureau of Mines Inf. Circ. 7875, 1959, 47 pp.

Describes methods and costs of mining and milling lead ore at Indian Creek mine of St. Joseph Lead Co., Washington County, Missouri.

56. CLARK, WILLIAM G. How to Control Project Cost. Petrol. Refiner, vol. 38, No. 9, September 1959, pp. 267-270.

Describes a method used by Dow to effectively control project expenditures from critical estimate to final construction.

57. COAL AGE. Third Overload Relay for Three-Phase Motor Starters. Vol. 64, No. 9, September 1959, pp. 84-85.

Discusses third overload relay for three-phase motor starters. Approximate costs of heater and third overload relay installed in starters is included.

58. COAL UTILIZATION. Coal Powers New Memphis Station. Vol. 13, No. 8, August 1959, p. 27.

Huge power plant burning 300 tons of coal per hour at rated generator capacity has been built at Memphis (Tenn.) at cost of $121 million. Plant utilizes Mississippi River as source of condensing water. Station initially consists of three 250,000-kw. units.

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59. COHEN, KARL, AND ZEBROSKI, E. Operation Sunrise. Nucleonics, vol. 17, No. 3, March 1959, pp. 63-71.

General Electric Co. proposed a program to carry three complimentary boiling-water concepts (developmental, evolutionary, and target) from demonstration stage to competitive position. The gross cost of this program, Operation Sunrise, is about $128-million which includes about $90-million for the construction of four new developmental boiling-water plants and $38-million for the research, development, and test activities required to design and build those plants.

60. COLTEN, OSCAR A. Basic Raw Materials in the Petrochemical Industry. Ind. Eng. Chem., vol. 51, No. 9, Part I, September 1959, pp. 983-984.

Considers importance of availability, location, and processes in determining petrochemical raw material. Example includes acetylene investment and operating cost from natural gas.

61. CONNALLY, HAROLD T. Kerr-McGee's Experience With Catalytic Desulfurization of Cat Cracker Charge Stock. Oil Gas Jour., vol. 57, No. 38, Sept. 14, 1959, pp. 88-92.

Relatively new distillate hydrodesulfurization unit producing gasolines and distillate fuels meeting product specifications expected for next several years has been installed at Wynnewood, Oklahoma. Operating costs are included indicating that hydrogenation of cat cracker charge stock is not an extremely profitable operation, but product quality is greatly improved.

62. COPULSKY, WILLIAM, AND SHINAGEL, FRED. Japanese Competition in Some World Chemical Markets. Ind. Eng. Chem., vol. 51, No. 8, August 1959, pp. 42A-45A.

Discusses two lines of chemical products (nitrogen fertilizers and plastics) in an attempt to better understand problem of world competition in these two lines. Also discusses non-competitive fields. Japan is country exemplified. Available cost data shows that Japan can produce and sell some products below world prices; for others, Japanese costs are above world levels.

63. CORNWELL, C. F., AND DAHLSTROM, D. A. The Belt Filter Concept. Chem. Eng. Prog., vol. 55, No. 12, December 1959, pp. 68-73.

Conventional continuous vacuum drum filter will reduce down time, maintenance, and labor costs, improve coke dewatering and washing results, and increase productive capacity. Cost figures are included.

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64. COST ENGINEERING. Cost Literature--1958. Vol. 4, No. 1, January 1959, pp. 21-47.

Abstracts of articles containing cost information which were published in Cost Engineering during 1958.

65. _____. Plate-and-Frame Filter Presses. Vol. 4, No. 1, January 1959, pp. 18-20.

Two nomographs given which make it easy to determine size and cost of plate-and-frame filter presses.

66. _____. Smith Turbine Type Mixer. Vol. 4, No. 1, January 1959, pp. 16-17.

Capacities, dimensions, and approximate costs are given for Smith Turbine Type Mixer. Mixer is used for blending several solids, or solids and liquids.

67. COTTER, J. L., AND MALEY, L. E. Selection of Components for Gas Analyzer Sampling Systems. Chem. Eng. Prog., vol. 55, No. 5, May 1959, pp. 122, 124, 126.

Evaluates commercially available filters, pressure regulators, valves, condensate traps, and sample conditioners with respect to advantages, limitations, and costs.

68. COWAN, JACK C. New Developments in High Temperature Drilling Fluids. World Oil, vol. 149, No. 5, October 1959, pp. 116-119, 127.

Current drilling operations are exploring formations at depths of 20,000 feet to 25,000 feet with temperatures ranging above 400° F. Surfactant muds were designed to cope with high temperature problem. These muds have, for the most part, utilized cellulose and polyacrylate derivatives for filtration control. Tables showing cost and efficiency of lignite-sodium alkali with filtration controls are included.

69. CRONAN, C. S. Maleic-Phthalic Race Breeds New Processes. Chem. Eng., vol. 66, No. 25, Dec. 14, 1959, pp. 78-82.

Brief technical description of 7 processes with investment costs for 3 of the processes.

Product	Process	Size Million lb./yr.	Capital Cost
Phthalic	Badger fluid-bed	20-30	$250/annual ton
Phthalic	Scientific design fixed-bed	20	$3.5 million
Maleic-Fumaric	Proprietary fixed-bed	2.4	$600,000-$1 million

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70. CRONAN, C. S. New Desulfurizing Process Takes Hold. Chem. Eng., vol. 66, No. 22, Nov. 2, 1959, pp. 26-27.

New electrostatic desulfurization process, used in conjunction with sulfuric acid contacting, uses new chemical engineering tool--electrostatic mixing--to remove sulfur efficiently. Sulfur removal can be as high as 95 percent. Cost of 10,000 barrel-per-day unit is about $350,000. Total operating costs vary from 7.9 cents per barrel using fresh acid down to 4.8 cents per barrel if spent alkylation acid is used.

71. _____. Radioisotopes Outlook:-New Supply Hastens Growth. 1. First Kilocurie Plant Now On Stream. Chem. Eng., vol. 66, No. 23, Nov. 16, 1959, pp. 96-98.

A new $3-million pilot plant separates kilocurie quantities of fissicn products (radioisotopes) from fuel-processing waste by a chemical process and lowers radioisotope costs as follows:

	Was	Now
Strontium 90	$500/curie	$10/curie
Cesium 137	$14/curie	$2/curie

72. _____. Small Volume Pure Hydrogen at Bulk Cost. Chem. Eng., vol. 66, No. 16, Aug. 10, 1959, pp. 60-62.

New low-temperature purification technique is going through its initial paces turning out 99.99 percent hydrogen at Van deMark Chemical plant in Linden, N. J. This hydrogen is being produced by low temperature techniques from dehydrogenation of isopropanol and sec-butanol producing acetone and methylethylketone from a complex refinery offgas. Hydrogen capacity is 15 million standard cubic feet per month for plant costing $200,000-$250,000 with an energy demand of about 200 horsepower.

73. _____. Two-Stage Cat Cracking Proves Out. Chem. Eng., vol. 66, No. 11, June 1, 1959, pp. 46, 48.

Presents comparative investments and operating costs for catalytic cracking units at several production levels.

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D

74. DEAN, JOHN G. The Industrial Growth of Nickel Compounds. Ind. Eng. Chem., vol. 51, No. 10, October 1959, pp. 48A-53A.

Nickel compounds serve as basic raw material for variety of key industries. Less than 5 percent of total nickel produced is consumed in form of compounds. Discusses industrial growth of nickel compounds. Includes cost table for common derivatives.

75. DEINDOERFER, FRED H., AND HUMPHREY, ARTHUR E. Design of Multistage Systems for Simple Fermentation Processes. Ind. Eng. Chem., vol. 51, No. 7, July 1959, pp. 809-812.

In a process description and comparison, includes qualitative discussion of batch versus continuous operating costs for fermenters.

76. DENSMORE, R. H. These Factors Affect Exchanger Costs. Petrol. Refiner, vol. 38, No. 9, September 1959, pp. 289-292.

Discusses how type of construction, design pressure, and tube layout can affect cost of heat exchangers.

77. DOBRATZ, C. J. Put the Viscous Fluid in the Shell. Chem. Eng., vol. 66, No. 6, Mar. 23, 1959, pp. 179-180.

Estimated cost for 2 heat-exchange designs having an area of 565 square feet, as shown by tables in article, is $6,000 for caustic in the tubes (alloy tubes and tube-sheet), and $7,200 for caustic in baffled shell (all alloy construction). The twofold greater overall coefficients for heat exchanger with caustic in shell would more than compensate for difference in cost.

78. DUNNING, H. N., AND EAKIN, J. L. Foaming Agents Are Low-Cost Treatment for Tired Gassers. Oil Gas Jour., vol. 57, No. 6, Feb. 2, 1959, pp. 108-110.

Gives inexpensive ways of reviving drowned gas wells and restoring them to production. Cost of treatment for gas wells with foaming agents range from about $3 to $10 per well.

79. DWYER, ROY P. Jet-Bit Deflection Saves Money in Directional Wells. Oil Gas Jour., vol. 57, No. 23, June 1, 1959, pp. 172-174.

Cost tables reveal economies to be realized by utilization of jet-deflection method wherever possible. Table 1 shows average costs of deflecting and drilling 15-inch surface hole using jet-deflection method, as compared with using whipstock. Table 2 shows drilling costs of 10,250-foot true vertical depth well.

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80. DWYER, ROY P. Jet Deflection...A Recent Advancement in Directional Drilling. Petrol. Eng., vol. 31, No. 5, May 1959, pp. B-77, B-80, B-82.

Contains essentially same information as Abstract 79.

81. New Technique Decreases Deflection Drilling Costs. World Oil, vol. 149, No. 1, July 1959, pp. 89-90.

Contains essentially same information as Abstract 79.

82. DYGERT, J. C. Power-Recovery Gas Turbines for Fluid-Bed Processes. Oil Gas Jour., vol. 57, No. 17, Apr. 20, 1959, pp. 94-100.

For gas turbine-cat cracker burning 35,000 pounds per hour of coke, installed cost of external separator and gas turbo-compressor equipment is approximately $1,500,000. However, steam turbo-compressor requires steam and cooling water, and with condensing-turbine these utilities would cost additional $1,000,000.

On basis of condensing-turbine capable of driving air compressor for plant of this size, operating cost is about 5.4 mills per hp.-hour, and thus for steam factor of 0.90, operating cost is approximately $400,000 per year.

E

83. EARLOUGHER, R. C. Analyzing Water-Flood Data. Oil Gas Jour., vol. 57, No. 25, June 15, 1959, pp. 90-93.

Discusses system using IBM 604 calculator and 407 tabulator to develop water-flood data. Initial costs of water-flood project for data processing equipment ranges from $2 to $3 per well. After system is begun, monthly costs range from 40 to 70 cents per well, depending upon size of project.

84. EDMONDSON, CAMERON. Alaska: Swanson River Field Development. Petrol. Eng., vol. 31, No. 5, May 1959, pp. B-84, B-86, B-90.

Cost of drilling wells to date has been $600,000 to $900,000 each in Swanson River field of Alaska. For completing wells, 7-inch casing is set through production zone and perforated. Production string of 2 $\frac{1}{2}$-inch tubing is run above packer on zone. Mud is displaced with water and well swabbed in if necessary.

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85. EVERETT, F. D. Sinking Methods and Costs at the Burgin Shaft, Bear Creek Mining Co., East Tintic Project, Utah County, Utah. Bureau of Mines Inf. Circ. 7879, 1959, 26 pp.

Describes sinking methods and operating practices of Centennial Development Co., contracting firm for Bear Creek Mining Co., in sinking 3-compartment vertical shaft 1,100 feet. Tables are included showing costs and performance data for basic phases of shaft-sinking operation.

F

86. FAITH, W. L. Air Pollution Abatement...Survey of Current Practices and Costs. Chem. Eng. Prog., vol. 55, No. 3, March 1959, pp. 38-43.

Gives survey of current practices and costs in air pollution abatement. It deals chiefly with control of emissions from processing. Too many intangible factors prevent estimating total annual cost of air pollution abatement to chemical industry. However, 2 medium-sized companies with capital expenditures for air pollution abatement equipment amounting to $1,500,000 each for three-year period stated that these expenditures were between 2.5 and 5 percent of total capital expenditure.

87. FARRAR, GERALD L. Use of Electronic Digital Computers. Oil Gas Jour., vol. 57, No. 16, Apr. 13, 1959, p. 116.

Presents journal survey showing extent of oil industry's use of electronic digital computers. Survey questionnaire also includes costs and use of computing service companies.

88. FEKETE, ZOLTON. Offshore Compressor Platforms. Oil Gas Jour., vol. 57, No. 46, Nov. 9, 1959, pp. 141-142, 144-146, 148.

Reports Shell Oil Co.'s experiences in construction and operation of several plants off the Gulf Coast. Discusses several factors to be considered in design of any compressor installation to be built in water, accessible only by water or air transportation. Cost of platform varies greatly, depending on deck design, length of piling required, whether concrete or steel piling, and whether a template is required. Cost examples are included. Estimates indicate that in deeper waters, say about 50 feet, platform cost would be about $100 per square foot.

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89. FIELD, J. H., BRUNN, L. W., HAYNES, W. P., AND BENSON, H. E. Cost Estimates of Liquid Scrubbing Processes for Removing Sulfur Dioxide From Flue Gases. Bureau of Mines Rept. of Investigations 5469, 1959, 58 pp.

Estimates capital and operating costs for removing sulfur dioxide from flue gases of power plant of 120,000-kw. capacity by liquid-purification processes, using limestone, ammonia, or sodium sulfite as reactant. For flue gas containing 0.30 percent sulfur dioxide, capital costs range from about $1.75 to $5 million, and operating costs from $1.40 to $2.20 per ton of coal consumed. This is based upon annual consumption of 475,000 tons of coal.

90. FINO, A. F. Field Erected Storage Tanks. Cost Eng., vol. 4, No. 2, April 1959, pp. 4-18.

One of major costs entering into chemical or processing plant is investment for storage vessels. Costs for various field-erected storage vessels are given. Indicated costs on charts cover materials, fabrication, and erection of tank, standard fittings, and average values for transportation, field labor, and insurance.

91. FITCH, E. W. Save Power; Boost Profits. Oil Gas Jour., vol. 57, No. 25, June 15, 1959, pp. 94-98.

La Gloria Oil & Gas Co. has program to utilize waste power and thus improve process efficiency. Cost information backing this program of horsepower conservation is reviewed.

92. FRANZ, W. F., CHRISTENSEN, E. R., MAY, J. E., AND HESS, H. V. New Process Remove n-Paraffins. 1. The Texaco Selective Finishing Process. Petrol. Refiner, vol. 38, No. 4, April 1959, pp. 125-129.

Gives cost data calculated for application of Texaco Selective Finishing Process to hexane isomerate stream. Process improves octane ratings of gasoline by removing inferior straight-chain aliphatic hydrocarbons.

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G

93. GABEL, ARNOLD R., AND SCHMIDT, HERBERT W. Plastics for Corrosion Protection in the Chemical Industry. Chem. Eng. Prog., vol. 55, No. 11, November 1959, pp. 39-41.

Plastics are economically advantageous for corrosion protection in chemical industry. However, selection of plastic materials for specific job is difficult, since there are no handbook tables. Assuming correct generic type of plastic has been established, often times chemical engineers overlook possibilities of potential cost savings by allowing high comparative material costs to be reason for rejection of plastics. Initial costs and life expectancy will well make up for this. Maintenance costs are also low. Cost savings can be seen in this example.

Wood vent stack		Laminated polyster stack	
Material costs	$ 885	Material costs	$2,100
Installation costs	3,000	Installation costs	300

94. GHUBLIKIAN, J. R., CLAPHAM, J. B., DIXON, W. T., AND WIGFIELD, D. E. Atlantic's New $10,000,000 Wax Plant. Oil Gas Jour., vol. 57, No. 36, Aug. 31, 1959, pp. 83-86.

Investment cost for 250 ton-per-day unit paraffin-wax manufacturing plant is approximately $10,000,000. Plant uses Texaco solvent dewaxing process, which assures waxes having good hardness characteristics and high blocking temperatures.

95. GIBBON, ANTHONY. Carbon Dioxide Gas Increases Oil Output. World Oil, vol. 149, No. 2, Aug. 1, 1959, pp. 100, 102.

Carbon dioxide gas is being injected into waterflood input wells through 3/4-inch macaroni tubing string. Gas is mixed with input flood water at sand face and is forced out into reservoir with the water. Process combines standard waterflooding techniques with injection of carbon dioxide during fill up and early oil producing stages of flood at cost of $1\frac{1}{2}$ cents per barrel of water used. Since carbonated water is not used throughout life of project, additional cost per barrel of water (because of CO_2), will be approximately $\frac{1}{2}$ cent per barrel of water. Present cost of gas used in production of CO_2 is 25 cents per thousand cubic feet.

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96. GILL, J. A., AND CARNICOM, W. M. New Calcium-Treated Muds Slash South Louisiana Drilling Costs. Oil Gas Jour., vol. 57, No. 28, July 6, 1959, pp. 102-105.

New calcium-treated drilling muds are being used in South Louisiana. As a result of this new method of treating, mud costs have drastically been lowered. Costs for various types of calcium-treated muds are presented. Describes these muds and others currently being used in this important drilling area.

97. GILLINGS, D. W. Analog Aids Economic Estimation. Chem. Eng., vol. 66, No. 23, Nov. 16, 1959, pp. 187-189.

A British paper discusses the use of an analog computer for economic evaluation of projects, using the present worth technique. An example is included.

98. GRUCA, WALTER. Pneumatic Coal-Handling System. Coal Utilization, vol. 13, No. 4, April 1959, pp. 22-25.

Cost of 30 ton-per-hour pneumatic coal conveyor is $45,000 as compared to $115,000 for mechanical conveying system. Other savings resulted from reduced labor costs and ability to use lower grade and cheaper fuel.

H

99. HARDWICK, W. R. Block-Caving Mining Methods and Costs, Bagdad Mine, Bagdad Copper Corp., Yavapai County, Ariz. Bureau of Mines Inf. Circ. 7890, 1959, 28 pp.

Describes block-caving methods, practices, and costs at Bagdad Copper Corp. in Yavapai County, Arizona.

100. HARPER, E. A. Kerosene As Absorption Oil--How Good? Petrol. Refiner, vol. 38, No. 5, May 1959, pp. 144-146.

Using commercial kerosene as absorption medium for distillation unit, production could be increased and costs reduced. Table included summarizing cost of absorption oil to support this statement. Based on increase in absorption oil consumption of 10 percent and increase in delivered cost of 2 cents per gallon, added absorption oil cost is only $10.05 per day.

101. HARRIS, H. R. Practical Automation of Existing Fractionators. Petrol. Eng., vol. 31, No. 5, May 1959, pp. C48, C50.

Cost of analyzer and recorder with its sample system for fractionators in natural gas plants is $7,000 to $9,000. Computing machines to aid in natural gas fractionators cost approximately $1,500.

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102. HEMSTOCK, R. A. The Musk-Ox--Canada's Answer to Tough Terrain. Oil Gas Jour., vol. 57, No. 34, Aug. 17, 1959, pp. 126-129.

Large oil reserves are being located in remote areas in continental Canadian North and the Artic Islands. Industry is faced with problem of getting into these remote location. Imperial Oil, Ltd., is presently testing a huge track transporter called Musk-Ox. Costs for operating Musk-Ox as well as other means of transportation are discussed.

103. HENRY, A. D. Low-Cost Highwall Mining. Coal Age, vol. 64, No. 2, February 1959, pp. 104-109.

Face labor cost is 70.3 cents per ton and bit cost is 4.7 cents per ton in applying boring-type machine and an extensible belt to room-panel recovery under final highwall mining.

104. HERNDON, L. K., AND CLAFLIN, H. C., JR. High Energy Fuels. Ind. Eng. Chem., vol. 51, No. 9, Part I, September 1959, pp. 991-992.

Without absolute numbers, discusses relationships of costs in investment and operating costs.

105. HITCHCOCK, LAUREN B. Air Pollution Abatement a Management Problem. Chem. Eng. Prog., vol. 55, No. 4, April 1959, pp. 49-53.

Preventive measures are often costly in air pollution abatement, but prove to be wise investments. Figure 1 shows relationship between abatement costs and costs of penalties for pollution. Figure 2 combines costs of prevention and penalties so that minimum total cost can be roughly estimated.

106. HUFF, RUBLE L. Which Refrigeration Cycle Is Best? Petrol. Refiner, vol. 38, No. 2, February 1959, pp. 111-114.

Tables show how low investment and operating costs give the edge to vapor-compression refrigeration rather than absorption-system refrigeration. The determining factor is method used in recirculating the refrigerant.

J

107. JACKSON, GORDON. Air Drilling. What Does It Cost? How Successful Is It? Oil Gas Jour., vol. 57, No. 30, July 20, 1959, pp. 99-100.

Figures taken by Well Completions, Inc., for 226 wells and the 419,407 feet of hole air drilled in those wells show that average cost per foot for air was $1.37, or $0.92 per foot, exclusive of standby charges. Where no water was encountered in hole, footage cost sank to $0.77 per foot, or $0.51 plus standby.

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108. JAHREIS, CARL. Don't Overlook Diaphragm Pumps. Chem. Eng., vol. 66, No. 17, Aug. 24, 1959, pp. 135-138.

Diaphragm pumps solve transfer problems when pumping hard-to-handle liquids and slurries. Initial cost of diaphragm pumps, depending on size, range from $250 to $4,500.

109. JELEN, F. C. Don't Forget to Allow for Inflation. Chem. Eng., vol. 66, No. 6, Aug. 10, 1959, pp. 74, 76, 78, 80.

Discusses methods of reflecting inflation in corporate financial statements. States inflation should not be reflected in an increased depreciation allowance, but rather as a separate item. Describes methods of showing inflation in financial statements by combinations of indexes.

110. _____. Include Inflation in Cost Accounting. Petrol. Refiner, vol. 38, No. 7, July 1959, pp. 113-116.

Jelen notes that balance sheets and income statements use current dollars as expressions of value. However, such forms directly and indirectly contain dollars of other years and values. Presents a method to adjust financial statements to allow for inflation.

111. JOBE, R. G. New Design Cuts Pump Cost 20 Percent. Petrol. Refiner, vol. 38, No. 12, December 1959, pp. 109-112.

Shell Chemical's study of 650 process pumps shows a need for simplified installations and maximum interchangeability. The result: a new design vertical-centrifugal pump. Only one size meets 80 percent of the plant's requirements. Comparison of the installed costs for conventional medium-duty horizontal-centrifugal pumps in these services shows that installed costs (including the price of the pump) were reduced 20 percent to 35 percent below that of conventional pumps of cast steel construction.

K

112. KARVELAS, LOUIS P., AND COOPER, DALE O. These Factors Affect Rate of Return. Petrol. Refiner, vol. 38, No. 7, July 1959, pp. 117-120

Discusses factors which are often not included in rate of return calculations. This index cannot include competive situation, political climate, etc. Often does not include confidence in price and volume predictions. Often overhead and tax effects are omitted. Concludes that rate of return cannot be the only basis for management decision.

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113. KATELL, SIDNEY, AND FABER, JOHN H. What Does Tonnage Oxygen Cost? Chem. Eng., vol. 66, No. 13, June 29, 1959, pp. 107-110.

Presents economic cost analysis of commercially available oxygen separation plants yielding oxygen of either 95 or 99.5 percent purity. Capital requirement for tonnage oxygen plants available in sizes ranging from 150 to 1,000 tons per day is estimated to vary from $5,400 to $14,700 per daily ton. Operating costs before return on investment will vary between $4.80 and $10 per ton.

114. _____, AND CONSTANTINE, MARC T. Economic Aspects of Producing Pipeline Gas, Using Lurgi Generators for Gasifying Bituminous Char. Bureau of Mines Rept. of Investigations 5547, 1959, 11 pp.

Evaluates a plant designed and built to produce 90 million standard cubic feet per day of synthetic pipeline gas by Lurgi gasification of bituminous char. Estimated total capital investment is $76,499,800. With $4 per ton char, operating cost per thousand cubic feet equals $0.56. With $6 per ton char, operating cost per thousand cubic feet equals $0.66. Tables showing estimated capital requirements and estimated annual operating costs are included.

115. _____. The Economic Outlook for Pipeline Gas From Char Via the Lurgi Process. Coal Age, vol. 64, No. 8, August 1959, pp. 92-95.

Contains essentially the same information as Abstract 114.

116. KATELL, SIDNEY, FABER, JOHN H., AND DOUGLAS, JOHN W. Bibliography of Investment and Operating Costs for Chemical and Petroleum Plants, January-December 1958, Bureau of Mines Inf. Circ. 7916, 1959, 55 pp.

Annual bibliography listing cost articles published in 1958.

117. KATELL, SIDNEY, FABER, JOHN H., AND MADDOX, BRYCE L. Bibliography of Investment and Operating Costs for Chemical and Petroleum Plants, January-December 1957. Bureau of Mines Inf. Circ. 7884, 1959, 57 pp.

Annual bibliography listing cost articles published in 1957.

118. KATELL, SIDNEY, AND WELLMAN, PAUL. Nomograph of Gas Compression Costs and Power Requirements. Cost Eng., vol. 4, No. 4, October 1959, pp. 23-25.

Cost analysis of gas compression is compiled in nomograph form. Horsepower requirements are established first. Nomograph illustrates determination of theoretical and brake hp. and operating cost of an installation to compress 40,000 standard cubic feet per minute of 95 percent oxygen (K = 1.401) from 1 to 5 atmospheres.

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119. KEEN, R. E. World's Deepest Slim Hole. Petrol. Eng., vol. 31, No. 3, March 1959, pp. B-30 - B-34, B-36, B-37, B-40, B-41.

Table presenting major cost items and percent of total which was spent for each of these items in building world's deepest slim hole is contained in article.

120. KINNEY, GENE. Reclaiming Tank Bottoms by Solvent Treating. Oil Gas Jour., vol. 57, No. 17, Apr. 20, 1959, pp. 127-129.

Crude-oil storage tanks are being cleaned out by solvent treating instead of by mechanical means or by heating. This means larger percent of accumulations are recovered without transporting and treating plant cost. Results of these recovery costs are shown in various case histories presented in article.

121. KLENGEN, J. Unconventional Vessel Heads Save Cost. Chem. Eng., vol. 66, No. 3, Feb. 9, 1959, p. 130.

Unconventional design can save 20 percent in cost of constructing heads for pressure vessels if type of construction mentioned in article is used. Comparing costs:

Conventional head		Recommended head	
6'6" dished head, 1,350 lb.	$350	Conical dished head, 2' x 1' cylindrical section, 2' I.D. dished head, 1,450 lb.	$400
Two 6'6" I.D. flanges, bolts, nuts, packing, 1,000 lb.	400	Two 2' I.D. flanges, bolts, nuts, packing, 475 lb.	200
Welding and assembling	60	Welding and assembling	50
	810		650

122. KNAPP, LESTER, SCHOENHERR, ROMAN, BARGHUSEN, JOHN, AND SMUTZ, MORTON. A Polethylene Box-Type Mixer-Settler Extractor. Ind. Eng. Chem., vol. 51, No. 5, May 1959, pp. 639-640.

Total cost for polyethylene box-type mixer-settler extractor capable of handling liquids of varying degrees of fiscosity and density difference is $2,500. Detailed cost analysis for 56-stage mixer-settler included.

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123. KOHL, ARTHUR L., AND RIESENFELD, FRED C. Today's Processes for Gas Purification. 5.--Sulfur Dioxide Removal by Liquid Absorption. Chem. Eng., vol. 66, No. 12, June 15, 1959, pp. 147-151.

Deals with recovering SO_2 from stack gases to prevent air pollution. Chemical costs for 20 ton-per-day SO_2 plant for extracting SO_2 from stack gases by several processes included.

124. KRONOWITT, PHILIP. Fine Chemicals--Batch Processing. Ind. Eng. Chem., vol. 51, No. 9, Part I, September 1959, pp. 987-988.

Summary of factors to be considered in construction of batch-processed fine chemicals plant. Stresses economic balances. Includes percent breakdown for process, storage, auxiliaries and site preparation based on "a few projects." Also typical investments per employer and per dollar sales, steam generation plant costs, and waste treatment plant costs.

L

125. LABINE, R. A. Natural Gas Moves Into Steel Making. Chem. Eng., vol. 66, No. 26, Dec. 28, 1959, pp. 50-54.

M. W. Kellogg Co. is building 500 ton-per-day sponge-iron plant for Johalata y Lamina. This HyL sponge-iron process eliminates blast furnace in steel production. Cost of plant will be cut down to $29-$30 per annual ton.

126. _____. Secrets of Low-Cost Heavy Water. Chem. Eng., vol. 66, No. 21, Oct. 19, 1959, pp. 170-173.

Dual-temperature exchange process for making heavy water saves hundreds of millions of dollars over previous water-distillation processes.

Major part of cost of recovering deuterium from natural water (1 part D_2O to 7,000 parts H_2O) is steam and cooling water needed to heat and cool tremendous volumes of fluid passing between hot and cold towers. Jerome Spevack's process operating at Savannah River, S. C. is operating at cost of $13.50 per pound D_2O.

127. LAMBERT, DON E. New Fields Spur Gas Search Along Texas Gulf Coast. World Oil, vol. 149, No. 4, September 1959, pp. 113, 114, 117.

Increased activity is occurring along Texas' Gulf Coast. Operators are attempting to prove up downdip Hackberry trend by recent discovery of two gas condensate fields. Gas reserves in two fields--Port Acre and Port Arthur--are estimated at nearly one trillion cubic feet. Minimum costs for wells in both fields range from $175,000 to $225,000 or more for dry hole--$250,000 to $325,000 for producing well. Prevailing footage rates are $4 per foot to 10,200 feet. Mud costs range from $27,500 to $40,000, depending on hole size and trouble encountered.

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128. LANDSLY, GEORGE L. Run Several Refineries the Best Way. Petrol. Refiner, vol. 38, No. 2, February 1959, pp. 139-141.

Practical problem showing 6 refineries for which maximum throughput is not needed. The problem is to decide how much to cut back each of 6 refineries to achieve maximum profits. Costs are figured for each of four main items: production, marketing, transportation, and manufacturing. These costs are then combined in a simple table.

129. LANNEAU, K. P., AREY, W. F., PERRY, S. F., SCHRIESHEIM, A., AND HOLCOMB, H. A. A New Isomerization Process. Petrol. Eng., vol. 31, No. 7, July 1959, pp. C26-C27, C30-C32.

New isomerization process to improve octane rating of C_5/C_6 light virgin naphtha is being developed. Estimates for process investment and direct operating costs for low-temperature C_5/C_6 isomerization plants of two sizes are given.

130. _____. Get More Isomers at Low-Temperature. Petrol. Refiner, vol. 38, No. 6, June 1959, pp. 199-203.

Contains essentially same information as Abstract 129.

131. _____. New Isomerization Process Claims Octane Improvement at 5-10 Cents Per Octane-Barrel. Oil Gas Jour., vol. 57, No. 33, Aug. 10, 1959, pp. 90-92.

Contains essentially same information as Abstract 129.

132. LEACH, L. L., JR. Shortcuts to Insulation Selection. Petrol. Refiner, vol. 38, No. 7, July 1959, pp. 173-177.

Many factors must be considered when selecting insulation material, most important being service temperature. Greatest mistake is relying too heavily on time-honored K factor. Although conductance factors must be considered, this factor should not weigh too heavily in making material selection. One necessary consideration is to weigh cost of material and labor required before an insulation project can be specified or completely planned. Cost tables included.

133. LINDEN, H. R., AND REID, J. M. Ethylene Production Process Variables. Chem. Eng. Prog., vol. 55, No. 3, March 1959, pp. 71-78.

Some fixed cost and operating cost data given for producing ethylene by high-temperature pyrolysis of ethane and propane as feedstocks.

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134. **LOOMIS, F. B.** California's Hottest Gas Area is Getting Hotter. World Oil, vol. 149, No. 2, Aug. 1, 1959, pp. 96-98.

Gas drilling activity increased 100 percent in six months in northern California's Sacramento Basin. No end for this stepped-up gas play is in sight. Cost to drill and complete average Sacramento well of 4,500 to 7,500 feet is about $11 per foot. Drilling contract on footage basis will vary between $3 and $5 per foot depending on depth, location, season of year, etc.

135. **LORAIN, S. H., WELLS, R. R., MIHELICH, MIRO, MULLIGAN, J. J., THORNE, R. L., AND HERDLICK, J. A.** Lode-Tin Mining at Lost River, Seward Peninsula, Alaska. Bureau of Mines Inf. Circ. 7871, 1959, 76 pp.

Cost records for Lode-Tin mining at Lost River, Seward Peninsula, Alaska, although not well adapted to break down into basic-cost units, indicate that approximate cost of mining and processing ore during 6 months of comparatively stabilized operation was $17.56 per ton of ore milled, excluding exploration costs and capital charges but including smelting charges and Seattle office expense. The cost per pound of tin recovered during same period was $1.33, but average tin recovery was only $13.25 per ton of ore milled of approximately 60 percent of tin contained in heads.

136. **LOVE, FRANK H.** New Stations Feature 13,400-Hp. Gas Turbine. Petrol. Eng., vol. 31, No. 7, July 1959, pp. D9, D11-D12, D14.

Texas Eastern Transmission Corp. has installed four compressor stations representing new concept in automatically remote-controlled stations. Gas compression is provided by centrifugal compressor powered by 13,400-hp. gas turbine. By centralizing large horsepower in single unit company was able to construct stations at low cost of $2,500,000 each or $196.96 per horsepower.

137. _____. Texas Eastern Makes Significant Additions to Compressor Stations. Petrol. Eng., vol. 31, No. 11, October 1959, pp. D40, D47, D48.

Texas Eastern Transmission Corp. has made significant additions to several compressor stations. Single-unit station consisting of 15,000-hp. synchronous motor driving single-stage centrifugal compressor through speed increaser and two identical stations on the system has low initial cost, which breaks down as follows:

Cost of original station	$1,880,000
Cost of addition to station	1,638,000
Total cost of station	3,518,000
Total cost per hp. installed (based on 30,000 hp.)	$117.27

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138. LUCAS, W. R. Direct Oxygen Regeneration of Spent Petroleum Caustics. Ind. Eng. Chem., vol. 51, No. 2, February 1959, pp. 84A-85A.

Cost of oxygen for regeneration of spent refinery caustics is approximately $30 to $40 for each ton of sulfur oxidized per day.

Mc

139. McGHEE, ED. Surface Mud System. Oil Gas Jour., vol. 57, No. 42, Oct. 12, 1959, pp. 107-122.

Installed costs for centrifugal charging pumps used on drilling rigs for mud mixing and agitating is from $1,000 to $4,000 depending on whether pump is driven off main slush-pump shaft or separate prime mover.

140. McNAMARA, ROBERT F. How to Select a Gasoline-Recovery Plant. Oil Gas Jour., vol. 57, No. 47, Nov. 16, 1959, pp. 186-187, 189-190.

Studies whether or not to use oil absorption--or adsorption--for gasoline recovery. Figures showing operating costs for desiccant and oil-absorption plants operating on lean-gas and rich-gas streams are included. If determined that dehydration plant should be added to oil absorption plant, incremental cost would be approximately $1,500 to $2,000 per million cubic feet per day of plant capacity. Operating costs associated with this dehydration plant would be about 1.5 to 2.5 mills per thousand cubic feet of gas processed.

141. McNIEL, J. S., JR., AND NELSON, T. W. Thermal Methods Provide 3 Ways to Improve Oil Recovery. Oil Gas Jour., vol. 57, No. 3, Jan. 19, 1959, pp. 86-98.

Downhole heating, hot fluid injection, and in situ combustion are three thermal methods used to improve heat recovery. By utilizing these methods one will: (1) Realize a greater return on capital; (2) obtain the benefits of conservation of our national resources; and (3) remain competitive in total energy market. Various cost figures for these three thermal methods are given throughout article.

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M

142. MACEACHERN, J. P., AND SEAMAN, AL. Oil-Base Mud Passed Test In Deep, Hot Hole. Oil Gas Jour., vol. 57, No. 37, Sept. 7, 1959, pp. 201-203.

Shell Oil has drilled deepest well in state of Oklahoma at depth of 24,002 feet. Interesti ng feature of this drilling feat was use of oil-base mud for combating problems posed by deep hole and high temperature. Oil-base fluid was used from 20,120 to 24,002 feet. Lime-base mud had been used to depth of 20,130 feet. Total net cost for oil-base mud system on job amounted to $40,000, or about $285 per day or $10.30 per foot drilled. Cost comparison between mud-base and lime-base is included.

143. MANRY, J. T., III. Computer Control for Your Pipeline. Oil Gas Jour., vol. 57, No. 41, Oct. 5, 1959, pp. 172, 174-175.

Computers are gradually becoming part of individual pipeline operations. As designs of pipelines become more accurate in anticipating actual operation conditions, advantages will outweigh given disadvantages for computer control. Assuming cost of operating pipeline to be somewhere between $50 and $100 per installed horsepower per year, cost for company with 200,000 horsepower would run between $10,000,000 and $20,000,000, including operation, maintenance, depreciation, taxes, interest, and general office overhead.

144. MARTIN, JAMES W. Confidence in Coal. Coal Utilization, vol. 13, No. 11, November 1959, pp. 27-30.

State of Kentucky owns and operates more than 60 installations on coal. Survey of all installations showed uncertainty as to proper coal specifications at several state institutions. Not only did this survey facilitate improved specifications, but primary outcome was the development of a more comprehensive view of coal consumption problem. Personnel training, renovation of old equipment, and remedial engineering were answer to problem. Costs for repairing and reconstructing these installations are included.

145. MATHEWS, R. T. Air Cooling in Chemical Plants. Chem. Eng. Prog., vol. 55, No. 5, May 1959, pp. 68-72.

Discussion of economic and design data for air-cooled heat exchangers in chemical plants. Operating and fixed costs discussed qualitatively.

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146. MATTEINI, CARLO. Why SENN Chose GE Reactor. Nucleonics, vol. 17, No. 5, May 1959, pp. 95-99.

Cost data shows why SENN (Societa Electronucleare Nazionale, an Italian nuclear power syndicate) chose GE (General Electric) reactor for Italy's first nuclear plant.

147. MEKLER, VALENTINE, AND BROOKS, MAURICE E. Delayed Coking. Petrol. Eng., vol. 31, No. 10, September 1959, pp. C7-C14.

Payout time for a delayed coking unit has been calculated as a function of charge stock and coke values. Charges interest on investment as an operating expense. No allowance for depreciation cash flow.

148. _____. When Is Delayed Coking Worthwhile? Petrol. Refiner, vol. 38, No. 6, June 1959, pp. 169-176.

Describes operation and development of delayed coking process. Process description is limited, but it does tie in with discussion of process variables, their effect on yields, design of critical equipment, and cost data showing economics of coking.

149. MICHELS, E. C. Variable-Speed Drive Cuts Power Costs. Oil Gas Jour., vol. 57, No. 44, Oct. 26, 1959, pp. 79-82.

Cherokee Pipe Line Co. has developed eddy-current drive which transmits rotation from constant-speed motor to centrifugal pump. This variable-speed drive cuts power costs. Cost figures included.

150. MILLER, E. R. Clean Heat Exchangers? Petrol. Eng., vol. 31, No. 11, October 1959, pp. C25-C28.

Develops an index which can be used to determine what the optimum cleaning frequency for heat exchangers should be. Balances the value of the heat saved against the cost of cleaning.

151. MCNAHAN, REX, AND RUTLEDGE, ROBERT D. Midwest's Newest Oil Province. Oil Gas Jour., vol. 57, No. 38, Sept. 14, 1959, pp. 167-168, 170-172, 174.

New oil provinces have been discovered in Southwest Nebraska-Northwest Kansas basin. They resulted in discoveries with pump gages of from 140 to 700 barrels of oil per day. Granite-test drilling costs for these discoveries range from $18,000-$25,000.

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152. MOORE, E. R., AND CUTLER, W. G. What It Costs Pacific Northwest Pipeline to Dehydrate With Calcium Chloride. Oil Gas Jour., vol. 57, No. 31, July 27, 1959, pp. 166-167, 169.

Pacific Northwest Pipeline Corp. has been using calcium chloride in individual wellhead dehydration units to process in excess of 100 billion cubic feet of natural gas. Weighted average cost for dehydration is $3 per million cubic feet of gas.

153. MORRIS, W. S. Cleaning Asbestos-Cement Pipelines in Salt Water Disposal Service, East Texas. Petrol. Eng., vol. 31, No. 7, July 1959, pp. B-46 - B-49.

Discusses some details in connection with maintenance of over 380 miles of asbestos-cement pipelines used for saltwater gathering. This salt must be collected so that deposits of scale will not be left in the wells to clog pores in sand and reduce effectiveness of injection. Comparative costs of various pipe cleaning methods are included.

N

154. NAKAYAMA, E. U. Find the Best Air Fin Cooler Design. Petrol. Refiner, vol. 38, No. 4, April 1959, pp. 109-114.

Gives cost tables for practical methods to be used when computing and evaluating optimum air fin cooler design. They show the following: (1) Air fin unit size versus estimated total investment cost; and (2) air fin unit size versus estimated cost of unit installed.

155. _____. Optimum Air Fin Cooler Design. Chem. Eng. Prog., vol. 55, No. 4, April 1959, pp. 46-48.

Contains essentially same information as Abstract 154.

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156. NELSON, W. L. Process Costimating. Oil Gas Jour.

This is a series of cost estimating articles appearing in the Oil and Gas Journal. They show current cost indexes for equipment, plants, and associated items.

Ref. No.	Title	Vol.	No.	Date	Page
156-1	Itemized Cost Indexes	57	1	Jan. 5, 1959	108
156-2	Water Required for Distillation and Its Cost	57	3	Jan. 19, 1959	107
156-3	Cost of Operating Vacuum Distillation Units (Lubes)	57	4	Jan. 26, 1959	221
156-4	Fractionation-Type Processes--Operating Costs	57	7	Feb. 9, 1959	121
156-5	Average Wages and Number of Refinery Employees	57	8	Feb. 16, 1959	163
156-6	Effect of Location on Refinery Costs	57	11	Mar. 9, 1959	184-185
156-7	Cost of Crude Oil Desalting	57	14	Mar. 30, 1959	167
156-8	Itemized Cost Indexes	57	15	Apr. 6, 1959	166
156-9	Operating Costs - Thermol Reforming	57	16	Apr. 13, 1959	111
156-10	Operating Costs - Thermol Cracking	57	19	May 11, 1959	122
156-11	Process Operating Costs-Caustic Washing	57	23	June 1, 1959	180
156-12	Itemized Cost Indexes	57	28	July 6, 1959	133
156-13	Operating Costs - Coking	57	29	July 13, 1959	117
156-14	Operating Costs of Gas-Recovery Plants	57	32	Aug. 3, 1959	109-111
156-15	Operating Costs - Fractionation and Gas Recovery	57	34	Aug. 17, 1959	225
156-16	Itemized Cost Indexes	57	41	Oct. 5, 1959	162
156-17	Operating Cost of Gas-Compressor Stations	57	44	Oct. 26, 1959	98
156-18	Operating Costs - Polymerization	57	48	Nov. 23, 1959	87
156-19	How to Figure Cost of Refinery Gas Compression	57	53	Dec. 28, 1959	173

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157. NELSON, W. L. Questions on Technology. Oil Gas Jour.

A series of technological questions and answers are discussed in the Oil and Gas Journal by W. L. Nelson.

Ref. No.=		Vol.	No.	Date	Page
157-1	Costs of Oil-Field Equipment	57	6	Feb. 2, 1959	115
157-2	Effect of Technological Improvements (Labor Productivity) On Cost Indexes	57	9	Feb. 23, 1959	152
157-3	Economical Size of Refineries	57	13	Mar. 23, 1959	102, 104
157-4	What's the Cost of Refinery Gas-Recovery Plants?	57	30	July 20, 1959	89
157-5	Cost of Small Carbon-Black Plant	57	30	July 20, 1959	89
157-6	Cost of Caustic Washing	57	43	Oct. 19, 1959	132
157-7	Gas-Compressor-Station Brought Up to Date	57	45	Nov. 2, 1959	79
157-8	Labor Cost of Vessels	57	45	Nov. 2, 1959	79

158. _____. Refinery Cost Indexes. Oil Gas Jour.

A series of articles appearing monthly in Oil and Gas Journal. Included are refinery construction cost indexes for pumps, compressors, electrical machinery, internal combustion engines, instruments, heat exchangers, miscellaneous equipment average, materials component, labor component, and refinery construction. Beginning with article 7, June 1, the Nelson index was expanded to include refinery operating cost indexes.

Ref. No.	Vol.	No.	Date	Page
158-1	57	1	Jan. 5, 1959	105
158-2	57	4	Jan. 26, 1959	153
158-3	57	6	Feb. 2, 1959	94
158-4	57	11	Mar. 9, 1959	183
158-5	57	15	Apr. 6, 1959	156
158-6	57	19	May 4, 1959	99
158-7	57	23	June 1, 1959	171
158-8	57	28	July 6, 1959	105
158-9	57	32	Aug. 3, 1959	98
158-10	57	37	Sept. 7, 1959	203
158-11	57	41	Oct. 5, 1959	159
158-12	57	45	Nov. 2, 1959	77
158-13	57	50	Dec. 7, 1959	112

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159. NORDEN, R. B. Electric Current Ends Process Corrosion. Chem. Eng., vol. 66, No. 24, Nov. 30, 1959, pp. 112, 114, 116.

Anodic metal passivation via impressed currents has been applied for corrosion control in a sulfonate plant. Conco has developed this electronic and electrode system capable of precise current control which will eliminate equipment corrosion. Each piece of equipment requires separate controllers. Cost of controllers, including installation, are between $50 and $5,000 depending on complexity of the installation. Operating costs for neutralizing installation are included.

160. _____. Now Isophthalics Challenge Epoxies. Chem. Eng., vol. 66, No. 18, Sept. 7, 1959, pp. 176, 178, 180.

Discusses Oronite's chemical resistant isophthalic-based maintenance compounds. These polyesters are based on isophthalic acid. Costs for these corrosion-resistant materials for various applications are included.

161. NUCLEONICS. Advanced Reactor Studies. Vol. 17, No. 8, August 1959, p. 59.

Advanced reactor study showing four concepts--pressurized water (PWR), boiling water (BWR), organic cooled (OMR), and heavy-water moderated (HWR)--all come out with predicted power costs of about 1 mill per kilowatt-hour above competitive rate. Table showing estimated costs for advanced concepts is included.

162. _____. AEC Backs 8 New Reactors, Cuts Down 2 Others. Vol. 17, No. 3, March 1959, pp. 17-18.

Reviews highlights of AEC's 1960 reactor program embracing 8 new projects--including the controversial Philadelphia electric gas reactor--and calling for de-emphasis of 2 sodium reactors sponsored by public power interests: Hallam, Neb., to be delayed, and Chugach, Alaska, now cancelled. Various reactor cost figures given for the 8 projects.

163. _____. AEC Status Reports for 10-Year Reactor Blueprint Claim 8.8-Mill Power for BWR and PWR Concepts. Vol. 17, No. 10, October 1959, pp. 20-21.

Presents report on status and prospects of 8 major reactor concepts under development in United States showing that pressurized and boiling water reactors could deliver electricity at power cost of 8.8 mills per kilowatt-hour at size close to 300 megawatts (e). Various cost estimates are included concerning these nuclear power costs.

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164. NUCLEONICS. D_2O Reactor Debate. Vol. 17, No. 3, March 1959, pp. 110-113.

Relates debate between W. B. Lewis and W. H. Newkirk concerning whether or not D_2O reactors built with today's technology would give about same power costs as light water reactors - namely around 11 mills per kilowatt-hour.

165. _____. Limited-Leakage Vs. Canned-Motor Pumps. Vol. 17, No. 5, May 1959, pp. 138, 141, 143, 144, 146.

Cost comparison between limited leakage versus canned-motor pump in reactor-primary-coolants system is presented.

166. _____. Progress Report on Solid Fuels. Vol. 17, No. 5, May 1959, pp. 100-103.

Reviews a discussion on high- and low-temperature fuels. Tables show power-cost breakdown, gross fuel-cycle costs for various reactors, rod cluster costs, and reprocessing costs for UO_2 and uranium metal.

O

167. OIL AND GAS JOURNAL. Air Cooling Saves for Sohio. Vol. 57, No. 15, Apr. 6, 1959, pp. 131, 134.

Exchanger-cost comparison shows that air cooling is more economical than conventional water cooling for many applications, even in locations where fresh water is plentiful.

168. _____. Analog Computers Solve Many Control Problems. Vol. 57, No. 41, Oct. 5, 1959, pp. 138-140.

Cost of installing analog computer controlling naphtha fractionation tower to capacity vapor rate is less than $10,000. Column is part of desulfurization unit and charges desulfurized light crude-naphtha stream.

169. _____. Blast Costs Estimated. Vol. 37, No. 17, Apr. 20, 1959, p. 61.

Cost of oil which could be produced by underground nuclear blast in western Colorado's oil shale area is estimated at $2 to $3 per barrel. A 300-kiloton device exploding 3,000 feet underground would break up 35-million tons of shale. Forty-seven percent of shale would be suitable for oil recovery by in situ combustion.

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170. OIL AND GAS JOURNAL. Can Underground Blast Make Shale Oil Competitive? Vol. 57, No. 2, Jan. 12, 1959, pp. 58-59.

Government experts estimate costs of proposed pilot nuclear blast project followed by in situ combustion in tremendous oil shale deposits in Rockies at about $1,200,000.

171. _____. Canada Seeks Sulfur-LPG Line. Vol. 57, No. 51, Dec. 14, 1959, p. 54.

Cost of carrying sulfur, propane, and butane to United States markets (from Calgary to Milwaukee) would be $190,000,000. Foothills Products Pipeline, Ltd., of Calgary is trying to obtain authority from state-government bodies in United States to do this.

172. _____. Completion Costs Cut. Vol. 57, No. 12, Mar. 16, 1959, p. 84.

Tubingless method of oil completion is reducing completion costs tremendously. This method cuts casing needs and saves money on pipe-hauling costs. Three tubingless completions in Seminole County, Oklahoma have cost an average of $18,400--compared with average of $23,800 for 7 regular wells.

173. _____. Crafts Are Issue.' Vol. 57, No. 6, Feb. 2, 1959, p. 56.

High operating costs will force abandonment of some marginal wells which would have produced for some time. Average lifting cost of oil is about 75 cents per barrel, with 60 percent (45 cents) of that direct labor costs. The 5 percent wage increase spreading throughout oil industry adds $2\frac{1}{4}$ cents per barrel to that average. This Port Arthur strike was called as this increase was spreading. With marginal wells operating costs run as high as $2.75 per barrel, and 80 percent ($2.20) of that is labor cost. Five percent boost then means an extra 11 cents per barrel out of producers pocket. This increase runs operating cost up to $2.86 per barrel.

174. _____. Foreign Holdings No Bonanza. Vol. 57, No. 19, May 4, 1959, p

High costs with slim returns face crude oil operators in foreign countries. Estimated costs range from $2,100 to $3,836 per barrel for building a transportation, refining, marketing organization in Eastern Hemisphere.

175. _____. Fuel-Oil Ban: Boon or Bust? Vol. 57, No. 51, Dec. 14, 1959, p. 53.

Los Angeles County has rule banning burning of oil in county containing more than 0.5 percent sulfur from May 1 to October 31. Discusses whether it was a boom or bust. Oil industry argues against it. Should this ban be placed on oil industry for year-round basis, cost of pipelines and related facilities necessary to supply natural gas to fuel users in country would be around $610,000,000.

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176. **OIL AND GAS JOURNAL.** Gas Lines Lease-Purchase Plan Approved. Vol. 57, No. 27, June 29, 1959, p. 43.

Cost of expansion project approved by Federal Power Commission for Texas Eastern Transmission Corp. to buy South Louisiana leases, including 22 miles of 14-inch line connecting reserves to Texas Eastern's system, is estimated at $49,088,000.

177. _____. Going Abroad? Try an Offshore Site. Vol. 57, No. 26, June 22, 1959, pp. 65-67.

ODECO (Ocean Drilling & Exploration Co.) drills cheaper on water than on land. Presently they are drilling in Mexico's Bay of Campeche. Rule-of-thumb cost estimate for ODECO's "El Dorado" drilling barge to complete foreign offshore well is as follows:

Move rig to site	$100,000
Drill for 30 days	250,000
Move rig out	100,000
	450,000

178. _____. Katy to Build 2,500-Mile LPG System. Vol. 57, No. 51, Dec. 14, 1959, pp. 50-51.

Cost of building 2,500-mile LPG pipeline system running from Permian basin to Minnesota and Wisconsin will be built at cost of $60,000,000. Line will be of 10 and 12-inch pipe with branches 6 and 8-inches. KATY will be first common-carrier LPG line.

179. _____. Liquid Methane May Stage U. S. Boom. Vol. 57, No. 6, Feb. 2, 1959, pp. 51-52.

Gives cost of using liquid methane for peak shaving as compared with other methods. Total fixed costs on this plant were estimated at $778,000 with operating costs for each full day of send out at $28,750. Thus, one-day sendout period would cost $806,750.

180. _____. Louisiana Has Best Offshore Future. Vol. 57, No. 24, June 8, 1959, pp. 106-107.

Through 1958 a total of 4,867,000 offshore acres have been leased by both federal and state governments for drilling at total cost to oil companies of $437 million for average of $90 per acre.

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181. OIL AND GAS JOURNAL. Midwestern Gets Word. Vol. 57, No. 46, Nov. 9, 1959, pp. 104-105.

Midwestern Gas Transmission Co. has won Federal Power Commission authorization to build Canada-United States pipeline. This pipeline will enable Midwestern to import 204,000,000 cubic feet of gas daily from Canada to North-Central United States. Estimated cost of project is $52,277,000.

182. _____. Molecular Sieves Look Good When Used With Isomerization. Vol. 57, No. 27, June 29, 1959, pp. 58-59.

Linde Co.'s evaluation of molecular sieves gives detailed information on fundamental properties, process design, and economics for using synthetic zeolites for separating normal paraffins from other hydrocarbon types.

183. _____. Onassis Gets Government Aid to Build Tankers. Vol. 57, No. 34, Aug. 17, 1959, p. 112.

Three large tankers are being built at an estimated cost of approximately $55,200,000 by Bethlehem Steel Co., Quincy, Mass. These vessels will include two 46,000-deadweight-ton supertankers and a giant 106,500-deadweight-ton tanker which will rank with largest vessels ever built. United States Government will insure loan of approximately $29,900,000 to help finance construction of these three tankers.

184. _____. Pipeliners Study Ways to Cross the Mediterranean Sea. Vol. 57, No. 35, Aug. 24, 1959, pp. 62-63.

Discusses engineering problem of laying pipeline across Mediterranean. Plastic pipe on bottom of the sea, and anchored steel line to sea floor floating 300 feet under surface are two engineering possibilities. Trans-Mediterranean gas pipeline, reaching from gas fields to Mid-European consumer would cost estimated $600 to $750 million.

185. _____. Process Adds Octanes Economically. Vol. 57, No. 24, June 8, 1959, p. 110.

New refining process--low-temperature isomerization of pentanes and hexanes--has been introduced. Approximate costs for typical application of new process has been worked out for 5,000 and 17,000 barrel-per-day plants. For 5,000 barrel-per-day plant, process investment is $400 per barrel per calendar day. Direct operating cost is 35 cents per barrel. For 17,000-barrel unit process investment drops to $250 per barrel per calendar day, and direct operating cost is reduced to 30 cents per barrel.

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186. OIL AND GAS JOURNAL. Tanker-Registry War Warms Up. Vol. 57, No. 7, Feb. 9, 1959, pp. 76-77.

Presents an attack by labor unions and European governments on American owned oil tankers flying under foreign flags. Aims are different, but results are same: Higher costs would put them out of competition. Typical operating costs included.

187. _____. Texas Eastern Finds Satellite Stations Successful. Vol. 57, No. 18, Apr. 27, 1959, pp. 96-97.

Cost of constructing remote-controlled, gas-turbine satellite compressor stations is $2,639,300 or $196.96 per installed hp. Controlling stations, which have three Westinghouse 5,000 hp. gas turbines driving Cooper-Bessemer compressors, cost $3,457,201, or $230.48 per horsepower. The remote-control equipment at satellite and control point costs $52,906.

188. _____. The Case for 27½% Depletion. Vol. 57, No. 9, Feb. 23, 1959, pp. 99-114.

Discusses proposed depletion allowance in oil industry. The argument is: Eliminate or reduce it and you put petroleum on a fair footing with other industries. The reduction the critics of oil industry seek is not a moderate one. It is a slash from 27½ percent to 15 percent. This issue explains why 27½ percent provision is needed today as never before. Cost figures backing argument are included throughout article.

189. _____. Which--Air or Water Cooling in Condensation of Overhead Vapor? Vol. 57, No. 19, May 4, 1959, pp. 113-114.

Gives factors to consider in choosing air or water as a cooling medium. Factors are: (1) Coolant supply; (2) weather and condensing temperature; (3) installation costs; (4) water-treating costs; (5) power costs; (6) space and location; (7) maintenance costs; and (8) blowdown disposal. Table included comparing the two mediums. Total operating cost and profit for air and water were $11,700 and $13,000, respectively.

190. OLIVE, M. J. How External Casing Corrosion Is Being Controlled in East Texas. World Oil, vol. 149, No. 1, July 1959, pp. 101-105.

Cathodic protection is most economical approach to corrosion control. Average cost of cathodic protection is $30 per year per well which includes power cost, depreciation, and maintenance. Average cost of rectifier unit is $460. Casing corrosion to date has cost more than $3 million in field even though most leaks occur at relatively shallow depths (0-500 feet) and are repaired at an average cost of $2,500 each.

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191. PALMER, MILO. Materials of Construction for Sub-Zero Temperature Service. Petrol. Refiner, vol. 38, No. 10, October 1959, pp. 107-109.

Materials of construction for sub-zero temperature service are rapidly expanding. Thus, information concerning behavior, relative costs, material availability, mechanical design, and safeguards concerning use of ferrous and non-ferrous materials in these services is in need. Discusses in general terms some materials of construction and mechanical design of piping and equipment. Table included showing relative costs of pipe materials.

192. PERKINS, BOB G. Heat Removal, Air or Water? Chem. Eng. Prog., vol. 55, No. 4, April 1959, pp. 41-44.

Shows cost comparisons of air versus water as cooling medium for condensing the following:

1. Acetic acid at atmospheric pressure.
2. Low boilers at atmospheric pressure.
3. Exhaust steam at atmospheric pressure.
4. Methanol at atmospheric pressure.
5. Methanol at 15 pounds per square inch gauge.

193. _____. Which Cooling Medium--Water or Air? Petrol. Refiner, vol. 38, No. 4, April 1959, 99-102.

Contains essentially same information as Abstract 192.

194. PETERS, WILLIAM C. Cost of Exploration for Mineral Raw Materials. Cost Eng., vol. 4, No. 3, July 1959, pp. 4-10.

Costs are given for various stages in mineral exploration. Cost figures are taken from generalized steps in complete exploration program which are: (1) Preliminary stage; (2) reconnaissance stage; (3) land acquisition stage; (4) target definition stage; (5) delineation stage; and (6) reserve estimation stage.

195. PETROLEUM ENGINEER. New Diamond Tools Perform More Efficiently and Economically. Vol. 31, No. 13, December 1959, pp. B-32 - B-34.

For coring and drilling operations new diamond tools have proven to be economically sound. Cost comparison shows that rock bit and diamond bit costs are about the same (including hard and soft formations) However, significant cost savings in favor of diamond bit result from greatly reduced number of round trips due to longer operating time on bottom. Average diamond bit cost for hard formation is $10.96 per foot as compared to average rock cost of $11.09 per foot. For medium hard formation, rock bit cost per foot is $5.07 as compared to diamond bit cost per foot of $5.80.

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196. PETROLEUM REFINER. Atlantic Completes Philly Wax Plant. Vol. 38, No. 7, July 1959, pp. 192, 197-198.

Methyl Ethyl Ketone (MEK) paraffin-wax plant handling eight different feedstocks through fourteen operations for full line of paraffin wax has started operating in Philadelphia (Pa.). It cost $18 million including auxiliary facilities.

197. _____. Construction Boxscore. Vol. 38, No. 1, January 1959, pp. 278, 281-282, 287-288, 291-292.

Lists the following information for oil, gas, and petroleum processing plants.

1. Company
2. Plant location
3. Project
4. Daily capacity
5. Estimated cost
6. Construction status
7. Licensor
8. Engineering
9. Contractor

198. _____. Petroleum Refiner's 1959 Maintenance Cost Survey. Vol. 38, No. 3, March 1959, pp. 136-138.

Contains graphs indicating maintenance costs as a percent of replacement costs. Maintenance costs include only direct, productive maintenance costs exclusive of burden or overhead.

199. _____. Tips on Maintenance From Panel Talks. Vol. 38, No. 12, December 1959, pp. 133-134.

Cost savings to be realized in maintenance in refineries and petrochemical and natural gasoline plants.

200. PHILLIPS, ROBERT J., AND NAPIER, H. G. Sulfur is Removed Now By New Process. Petrol. Refiner, vol. 38, No. 2, February 1959, pp. 151-154.

Describes use and economics (fixed investment) of electrostatic desulfurization unit.

201. PINK, JOHN F. Consider Uses for Analog Computers. Petrol. Refiner, vol. 38, No. 3, March 1959, pp. 215-220.

Improved automatic control will make greater use of both digital and analog computers. Cost curve comparing analog computer to digital computer, based upon number of plants required for optimization, is included.

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202. PLITT, FRED H. Adsorption Units--What's the Payout? Petrol. Refiner, vol. 38, No. 7, July 1959, pp. 169-172.

Gives cost study for recovering hydrocarbon liquids from natural gas. Method used is absorption by short-cycle units. Scope of this article is to indicate payout period for such equipment at varying conditions of gas content and volume rate.

203. _____. How to Determine Payout of Wellhead Absorption Units. World Oil, vol. 148, No. 7, June 1959, pp. 120-123.

Contains essentially same information as Abstract 202.

204. PODPECHAN, FRANK W. New Empire Abo Sparks Rush to Southeast New Mexico. Oil Gas Jour., vol. 57, No. 26, June 22, 1959, pp. 148-151.

Discovery of Empire Abo field in southeastern New Mexico has increased acreage purchases and drilling. Abo pay is barrier reef of lower Leonard (Permian) extending across this area in subsurface from depths of 4,500 to 8,300 feet. Presently it is producing in two fields some 50 miles apart. Both fields have large reserves. Drilling costs for these wells are little above average for producing depths but not excessive. Empire wells cost from $85,000 to $100,000 to complete and Lovington wells cost approximately $140,000.

205. POINDEXTER, ALLAN M. Minimizing Fuel-Processing Costs. Nucleonics, vol. 17, No. 11, November 1959, pp. 162, 164, 166, 168.

Cost of reprocessing is sometimes as high as 15 percent of total nuclear reactor fuel cost. AEC's present cost is $15,300 per day's use of reprocessing plant. Concludes that by using optimum reprocessing, batch size total reprocessing cost can be reduced.

206. POPE, P. O., AND MESAROS, JOHN. Low-Solids Muds Score High. Oil Gas Jour., vol. 57, No. 19, May 4, 1959, pp. 90-95.

Report on drilling muds used on 3 deep wells. Four tables which include costs are given.

207. PRATER, N. H., AND ANTONACCI, D. W. How to Estimate Cooling Tower Costs. Petrol. Refiner, vol. 38, No. 4, April 1959, pp. 119-124.

Presents method for accurately estimating cost of cooling tower installations. Data is given on cooling tower prices and installation costs in relation to capacity and design operating conditions for towers of capacities up to 75,000 gallons per minute of water.

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208. PRATER, N. H., AND ANTONACCI, D. W. Quickly Estimate Steam Plant Costs. Petrol. Refiner, vol. 38, No. 5, May 1959, pp. 243-246.

Fixed investment versus capacity is given for steam generating facilities and auxiliary equipment. Design pressures range from 200 to 700 p.s.i.g.

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209. RAGAN, J. T. Cost Figures of 45 Contractors Show Electric Drive Cust Rig-Upkeep Expense. Oil Gas Jour., vol. 57, No. 49, Nov. 30, 1959, pp. 74-75, 77.

Shows cost figures of 45 contractors based on study of 125 rigs ranging in depth capacity from 4,500 feet to over 20,000 feet, and some 28,000 days of rig operation. Shows that rigs equipped with electric drive as compared with mechanical-drive rigs of equal rating and comparable age are economically feasible. Cost comparisons are limited to operating-cost factors which are direct function of type of transmission used--either electric or mechanical.

210. RANSOHOFF, J. A. Use of Less Expensive Rare Earths as Control Materials. Nucleonics, vol. 17, No. 7, July 1959, pp. 80-82, 84.

Use of less expensive rare earths as control material, while not as unique as europium, are much more competitive with, and sometimes superior to, other control-rod materials now being used. Cost and availability of more abundant rare earths are presented to support this statement.

211. RAY, HUBERT L. Use of Air Cuts Costs in Short Hole Drilling. World Oil, vol. 148, No. 5, April 1959, pp. 129-130.

Shows that seismic short-hole drilling costs are being reduced when operators use air instead of water or mud. Actual cost figures backing this method of drilling are contained.

212. RECORDS, L. R. Louisiana Onshore Drilling Costs. Oil Gas Jour., vol. 57, No. 6, Feb. 2, 1959, pp. 102-105.

Cost graphs given are valuable help to management, geologists, engineers, and field drilling men as guide to average drilling costs for onshore wells in South Louisiana.

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213. REED, PAUL, AND KINNEY, GENE. Pipeline Costs Vary All Over the Map. Oil Gas Jour., vol. 57, No. 29, July 13, 1959, pp. 89-104.

Report examines cost of building, operating, and maintaining oil and gas pipelines. From current pipeline experience, certain rule-of-thumb cost estimates are included.

214. _____. Remote Control of a Large Single-Unit Gas-Turbine Compressor Station. Oil Gas Jour., vol. 57, No. 27, June 29, 1959, pp. 74-78.

Gives requirements of low investment and operating costs for remote-controlled large single-unit gas-turbine compressor station. Texas Eastern Transmission Corp. is remotely operating four single-unit stations each powered by 13,500-hp. gas turbine. This turbine drives two-stage centrifugal compressor at 4,860 r.p.m. Cost breakdown shows value of remote control component.

215. _____. Texas Eastern Successful With Large Electric-Motor and Gas-Turbine Centrifugal Compressor Stations. Oil Gas Jour., vol. 57, No. 37, Sept. 7, 1959, pp. 177-178, 181-182.

Large electric-motor and gas-turbine centrifugal compressor stations are rapidly gaining in popularity primarily because of rise of gas-turbine drive. Presents examples of latest types of electric-motor and gas-turbine centrifugal compressor stations with costs found in Texas Eastern Transmission Corp. system.

216. _____. The Florida Pipeline--A New Concept in Gas Transmission. Oil Gas Jour., vol. 57, No. 11, Mar. 9, 1959, pp. 108-116.

A 2,596-mile pipeline system from Baton Rouge (La.) to Miami (Fla.) overcomes supply, market, and legal obstacles and incorporates interesting design and construction features.

Because of low application cost, polyethylene tape for corrosion protection for pipeline system is used. A cost comparison between coal tar coating and polyethylene tape coating is included.

217. REIBEIN, C. A., MITCHELL, W. A., WILSON, R. A., AND MEDLIN, W. V. The Economics of Two-Stage Cat Cracking. Oil Gas Jour., vol. 57, No. 25, June 15, 1959, pp. 108,110, 112-119.

Economic study showing that two-stage catalytic cracking is compatible with today's major trends in petroleum refining toward increasing gasoline yield and quality. Cost information is discussed throughout.

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218. REINKEMEYER, L. R. Making High-Quality Asphalt. Oil Gas Jour., vol. 57, No. 37, Sept. 7, 1959, pp. 166, 168, 170-172.

Anderson-Prichard has designed and constructed crude-distillation unit using 3,000 barrels per day of propane to make high-quality asphalt. Total cost for unit is approximately $230 per barrel of charge. Table showing operating costs for propane deasphalter is given.

219. RIESENFELD, F. C., AND MULLOWNEY, J. F. For Acid Gas Removal... Giammarco-Vetrocoke Processes. Petrol. Refiner, vol. 38, No. 5, May 1959, pp. 161-168.

Operating costs for Giammarco-Vetrocoke processes for removal of CO_2 from gases essentially free of H_2S and another for selective H_2S removal, were estimated on basis of utility and labor costs. These processes are based on absorption of acid gases in alkaline solution containing inorganic or organic additives. Presents complete study of how these processes compare with conventional schemes, both technically and economically.

220. _____. The Giammarco-Vetrocoke Process for Acid Gas Removal. Oil Gas Jour., vol. 57, No. 20, May 11, 1959, pp. 86-91.

Contains essentially same information as Abstract 219.

221. ROBBINS, M. D. Maintenance Cost Estimation...Is This a Better Tool for You? Chem. Eng., vol. 66, No. 3, Feb. 9, 1959, pp. 140, 142.

Describes new method to estimate and control costs. One table correlates maintenance costs with investment and age. Second table explains how estimates can predict maintenance.

222. _____. Predicting Your Maintenance Costs. Chem. Eng., vol. 66, No. 14, July 13, 1959, pp. 172, 174, 176, 178.

Sequel to previous article on estimating maintenance costs as a function of (investment x age). Data is given for cement and coke plants. A modification which incorporates useful life of equipment is also described.

223. ROBERTSON, JAMES T. How to Select Refrigeration Equipment. Petrol. Refiner, vol. 38, No. 2, February 1959, pp. 115-122.

Practical guide to be used by designer in evaluating and selecting process chilling equipment is shown. Cost of refrigeration system varies with machinery used, system, available utilities, and load and temperature level at which refrigeration is accomplished. Table showing centrifugal-compressor refrigeration units cost per ton for various evaporator temperatures is included.

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224. SARRAF, R. J. Fluid-Bed Coat: Key to Better Valves. Chem. Eng., vol. 66, No. 26, Dec. 28, 1959, pp. 100, 102, 104.

Fluidized sintering of chlorinated polyether plastic produces homogenous, void-free, chemical-resistant coated valves costing 50 percent less than all-stainless steel.

225. SEGEL, K. D. Economics of Air Fin Coolers. Chem. Eng. Prog., vol. 55, No. 7, July 1959, pp. 71-72.

Shows that it is economically feasible to use air fin cooler rather than water cooled. However, there are times when an alternate method might be less costly. An investment and operating cost comparison of water cooled, air cooled, and combination water and air cooled system is presented.

226. SELLARS, CLAUDE A., JR. Shell Develops Unique Data Recorder For Automatic Well Testing. World Oil, vol. 149, No. 1, July 1959, pp. 79-84.

Machine-sensible analog multi-channel data recorder is being used by Shell Oil Co. for recording automatic well testing data. Cost of test programers varies with number of wells tested, amount of identification data, and type of enclosure required. However, an average unit serving 30 to 50 wells will cost about $4,000-$5,000.

227. SENATOROFF, N. K. Economics of Cathodic Protection. Oil Gas Jour., vol. 57, No. 30, July 20, 1959, pp. 107-108, 110.

Gives economic study of cathodic protection. Pacific Lighting Gas Supply Co. constructed 34-inch o.d. Grade X-52 transmission line in California. Costs for proposed cathodic protective system for this line are included.

228. SERGESKETTER, M. J. Centrifuges Pass Tests as Separators. Oil Gas Jour., vol. 57, No. 37, Sept. 7, 1959, pp. 162, 165.

Shell Oil Co. has completed tests on centrifugal dehydrators for removing produced water from crude oil. Tests show machines are practical for replacing conventional heater-treater in removal process. Operating costs for 1,000 barrel-per-day centrifugal dehydrator using 20 cents per thousand cubic foot of gas as basis are included.

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229. SHEARON, WILL H., JR., AND FULLEM, W. R. Silica-Alumina Petroleum Cracking Catalyst. Ind. Eng. Chem., vol. 51, No. 6, June 1959, pp. 720-726.

Silica-alumina petroleum cracking catalyst is most widely used cracking catalyst, because it yields highest octane gasoline and largest amount of petro-chemical raw materials. Plant, costing $7,000,000, has been designed for continuous and almost automatic operation to produce silica-alumina petroleum cracking catalyst.

230. SHERRED, J. A., AND FAIR, J. R. High Purity Propylene--A New Problem. Ind. Eng. Chem., vol. 51, No. 3, March 1959, Part 1, pp. 249-252.

Increased emphasis on new chemical uses for propylene require 99 percent purity. Cost curves for 50-50 propylene-propane separation by distillation are compared for operating pressure levels of 100, 200, and 300 p.s.i.a. and 90-10 propylene-propane separation for pressure level of 300 p.s.i.a.

231. SLYNGSTAD, C. E. Regenerative Catalytic Reforming. Ind. Eng. Chem., vol. 51, No. 9, Part 1, September 1959, pp. 993-996.

Relative investment and operating costs for catalytic reforming.

232. SMITH, SAMUEL W. New Concepts of Marginal Gasoline Plant Design. Petrol. Eng., vol. 31, No. 5, May 1959, pp. C13-C15.

Smaller marginal-type gas properties have been considered, applying latest engineering concepts and technology to determine if plants could be constructed and operated on a sound economic investment basis. Many designs have been made and evaluated for initial investment, earnings, utility, and operating costs. To reduce costs, many of niceties found in larger, permanent-type plants are eliminated. Two different plant designs with cost data included are presented to illustrate what can be done to solve some of these problems.

233. SNEED, ROBERT W. Operators in Rockies Drill With Air and Bank the Savings. Oil Gas Jour., vol. 57, No. 30, July 20, 1959, pp. 101, 103-104.

Air drilling has been used to drill in almost every major Rocky Mountain basin. As result of air-drilling operations, Rocky Mountain operators have made big savings in direct well costs through reductions in rig time, in number of bits used, and in amount of drilling fluid required. Cost figures are presented throughout.

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234. SORELL, G. How and When to Use Plastic Pipe. Chem. Eng., vol. 66, No. 6, Mar. 23, 1959, pp. 149-170.

How and when to use plastic pipe is determined by cost. Plastic pipe generally costs less than corrosion-resistant metals. Most thermoplastics cost twice as much as carbon steel and thermosets run even higher. However, stainless alloys are about 10-20 times cost of steel.

235. SPEAR, W. G. Transistors Shrink Contamination Detectors. Nucleonics, vol. 17, No. 4, April 1959, pp. 97-101.

Transistor design produces compact, reliable alpha hand monitor to replace temperamental, expensive predecessor. A companion is a tiny instrument with both detector and adjustable pulse-height analyzer. This experimental instrument has operated continuously for 14 months with no maintenance or recalibration costs. Its cost is $2,200.

236. STANTON, W. H. How to Distribute Auxiliary Costs. Petrol. Refiner, vol. 38, No. 7, July 1959, pp. 110-112.

Method described for allocating auxiliary capital and costs for process plants which is based on the percent of total utility required by the product plant operating at rated capacity.

237. _____. Which Acetylene Removal Scheme Is Better? Petrol. Refiner, vol. 38, No. 5, May 1959, pp. 177-180.

Presents economics of absorption versus hydrogenation for removing acetylene from rich ethylene streams. Cost comparisons between acetylene removal systems are included.

238. STEKOLL, MARION H., AND HODGES, W. L. Use of Small Diameter Casing Reduces Well Costs. World Oil, vol. 148, No. 2, Feb. 1, 1959, pp. 70-74.

Five-thousand-foot wells equipped with a 2 7/8-inch casing will cost $7,500 to $8,500 less than a well completed with $5\frac{1}{2}$-inch pipe. Outlines field case histories of such practice and delineates procedures and experiences with use of casing over 15-year period. Also includes itemized inventory of all costs of typical 3,000-foot slim hole.

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239. **STIFF, HENRY A., JR.** Corrosion: Holes in the Oil Industry's Pockets. Petrol. Eng., vol. 31, No. 5, May 1959, pp. B-19 - B-24.

Direct annual cost of corrosion in United States for oil industry has been conservatively estimated at $5.5 billion. Corrosion costs rank with government costs as one of our major national expenses. Presents items in corrosion bill that are annually presented to American industry, and ultimately paid for by John K. Consumer.

240. **STOKES, C. A.** Economic Evaluation Organization and Coordination. Chem. Eng. Prog., vol. 55, No. 5, May 1959, pp. 60-67.

Discusses following factors in coordination and organization of an economic evaluation group:

1. Purpose and scope
2. Methods of approach
3. Sources of data
4. Programing
5. Staffing
6. Position in company structure

241. **STONE, C. T.** Jet Engine Lubricants. Ind. Eng. Chem., vol. 51, No. 5, May 1959, pp. 56A-57A.

Despite an original cost of $10 per gallon, synthetic lubricant markets for aircraft turbo-jet engines represent over 1,000,000 gallons yearly for specification MIL-L-7808 type lubricants. Cost of lubricants is high, but Air Force is convinced that better lubricants are needed regardless of price. Performance-type test evaluating lubricant cost to be more than $100,000.

242. **ST. ONGE, GEORGE H.** Large Motors for Compressor Drives. Petrol. Refiner, vol. 38, No. 5, May 1959, pp. 203-208.

Presents engineering experience gained in application and installation of motors 1,500-horsepower and larger. In all of 29 installations studied in article, squirrel-cage motor drives centrifugal air blower or gas compressor through speed increasing gear. Relative costs are presented for the following:

1. Three voltage levels of drip-proof 1,200 r.p.m. motors.
2. Three speeds of drip-proof 2,300-volt motors.
3. Three enclosure types 2,300-volt 1,200 r.p.m. motors.

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243. STORMONT, DAVID H. Bottom-Hole Heating. Oil Gas Jour., vol. 57, No. 47, Nov. 16, 1959, pp. 154-157.

California's Tidewater Oil Co. has developed bottom-hole heating system. Surface heaters are designed to circulate hot water to four producers. Average daily oil increase as result of new bottom-hole heating system has been about 13 barrels. Most new wells produce in 20 to 25 barrel range when heated, and drop to about 15 to 25 barrels of oil daily when heat is cut off. Costs of drilling and completing new wells varied widely, depending upon field, and whether or not they were development or semi-exploratory. Average well costs range from $13,000 to $30,000. Cost of equipping well for bottom-hole heating averaged about $1,700 per well where four-well units were used. Average fuel cost is about $2 per day with four-well heaters.

244. _____. New Plants Boost Wilmington's Water-Injection Capacity. Oil Gas Jour., vol. 57, No. 52, Dec. 21, 1959, pp. 66-69.

Two recently completed plants in California's Wilmington oil field have new standards for capacity, compactness, and automatic control in high-pressure water injection. Electric motors drive multi-stage centrifugal pumps. Both plants operate unattended. Cost table for plants is included.

245. _____. New Process Has Big Possibilities. Oil Gas Jour., vol. 57, No. 44, Oct. 26, 1959, pp. 48-49.

Low temperature hydrocracking process called "Isocracking" has been developed by California Research Corp., research subsidiary of Standard Oil Co. of California. This catalytic process working on such charge stocks as coker distillate and refractory cycle oil results in better than 100-percent yields of very high-octane gasoline components. On-plot cost of catalytic unit ranges from $350 to $450 per daily barrel of reactor charges.

246. _____. World's Biggest Water Flood. Oil Gas Jour., vol. 57, No. 36, Aug. 31, 1959, pp. 55-60.

California's Wilmington field is gradually becoming world's largest water flood. Currently about 215,000 barrels of ocean brine is being injected daily in several separate projects. By July 1960, more than 1,000,000 barrels of water daily will be injected through 230 wells. Total cost of plants, lines, and injection wells for increased activity is estimated to be about $31,000,000. Plants alone will cost about $7 per barrel daily capacity. Estimated average cost of water delivered to operator, including operating costs and amortization of facilities, will run less than 1 cent per barrel.

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247. STRICKLING, HARRY L. Make Your Own Cost Charts. Chem. Eng., vol. 66, No. 7, Apr. 6, 1959, pp. 131-134.

Explains the techniques and use of a cost chart for cost estimating data to save time and money.

248. STRUTH, H. J. Oil Finding Costs Hit New Peak. Petrol. Eng., vol. 31, No. 1, January 1959, pp. B-24 - B-30.

Presents annual cost study showing: (1) How rising costs, diminishing returns pose serious problem; and (2) adequate crude price, depletion allowance necessary to maintain sufficient reserves as oil finding costs hit new peak. In 1957, initial cost of finding barrel of oil in United States was $1.33; whereas, median cost of finding barrel of oil in last 21 years was only 57 cents. Thus, every barrel of oil, which previously cost 57 cents, must be replaced with new oil reserves at cost of $1.33

249. STYRNA, STANLEY. Mechanical Drive Steam Turbine Application. Petrol. Refiner, vol. 38, No. 3, March 1959, pp. 185-188.

Contains data showing how costs can be reduced by applying a mechanical-drive steam turbine. It shows how combined turbine initial costs and fuel costs vary over a range of steam conditions, speeds, and ratings. Also tells how costs can be reduced by properly specifying turbine's efficiency level and its normal operating point.

250. SWAIN, PAUL E. Gas Conservation Becoming Popular in Saudi Arabia. Oil Gas Jour., vol. 57, No. 25, June 15, 1959, pp. 84-85.

Middle East trend is to reinject gas to maintain reservoir pressures. Arabian American Oil Co. (Aramco) has built a reinjection plant at cost of $27,600,000. Plant has not been perfected, but work is being done toward it.

251. SZESZICH, DR. L. VON. Ocean Transportation of Liquefied Natural and Petroleum Gases. Oil Gas Jour., vol. 57, No. 2, Jan. 12, 1959, pp. 76-81.

Ocean transportation of liquefied natural and petroleum gases is economically feasible from an engineering-operating standpoint. Taking specific case and assuming distance between source and market to be 4,500 sea miles, total cost for regasified methane at point of use would be $0.512 to $1.324 per thousand standard cubic feet. Costs for all phases of this operation are included.

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252. THOMAS, JOHN W. Air Vs. Water Cooling Cost Comparisons. Chem. Eng. Prog., vol. 55, No. 4, April 1959, pp. 38-41.

Shows capital cost comparisons for air versus water cooling. These cost comparisons were made under operating conditions in petroleum refineries where water is plentiful.

253. _____. Air Wins, Even With Water Plentiful. Petrol. Refiner, vol. 38, No. 4, April 1959, pp. 103-105.

Contains essentially same information as Abstract 252.

254. THOMPSON, MARVIN L. In Deep-Well Pumping Know Your Well Loads. Oil Gas Jour., vol. 57, No. 18, Apr. 27, 1959, pp. 155-158, 163.

Proper application of pumping units is of primary importance regardless of depth. In deep-well pumping mechanical problems which occur at all depths become more complex and critical. Depth also magnifies equipment investment and cost of maintenance repair. Table showing pumping unit costs at various stroke lengths is included.

U

255. UPDEGRAFF, NORMAN C. Need Hydrogen? Examine This Process. Petrol. Refiner, vol. 38, No. 9, September 1959, pp. 175-178.

Hydrogen treating of refinery streams for feedstock preparation and product up-grading increases need for hydrogen. To meet this need American Gilsonite has installed separate hydrogen-producing facilities. By meeting capacity and purity requirements of refiner it is possible to produce hydrogen at direct cost of 15 to 20 cents per thousand cubic feet and total cost, including fixed charges, of 25 to 35 cents per thousand cubic feet. On basis of 90 to 95 percent pure hydrogen using normal plant specifications, investment costs supplied on battery limits will be $500,000. Plant capable of producing 10 million cubic feet per day of 90 percent hydrogen will cost approximately $2 million.

V

256. VAN SANT, J. N., AND ELLMAN, R. C. Methods and Costs of Mining Lignite in North Dakota. Bureau of Mines Inf. Circ. 7891, 1959, 82 pp.

Describes mining and preparation methods as well as costs in North Dakota lignite-producing area. Material was taken from 6 large mines operating in this area.

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257. VAN SOYE, C. C. Drying Problem? Try New Dielectric Heater. Chem. Eng., vol. 66, No. 3, Feb. 9, 1959, pp. 88, 90.

The first cost of Thermatool dielectric heater for drying water-laden rayon cokes without sacrifice of product uniformity has been produced at cost of about $140,000.

258. _____. Heat Exchanger Spins Away to High Flux. Chem. Eng., vol. 66, No. 14, July 13, 1959, pp. 102, 104.

Versatile new heat-exchange mechanism, Turb-O-Heat, crams heat transfer rates of 300,000 B.t.u. per hour into novel unit sized 20 by 20 by 30 inches. This steam generator continuously converts cold feedwater to 100 p.s.i.g.--within 15 seconds from startup. Cost is about $1,000.

259. _____. Pencilled Lines Guide New Programmer. Chem. Eng., vol. 66, No. 20, Oct. 5, 1959, pp. 64, 66.

New program-control technique, PreKorder, reads pencil-drawn program chart, controls process accordingly, and then superimposes record of process performance on same chart for continuous, visual comparison. Both circular and strip-chart models are currently available in broad range of scales, chart speeds, pen speeds, and auxiliary control functions. Approximate cost for strip-chart unit runs $1,200 to $1,500 more than comparable non-programming recorder-controllers; circular-chart models add about $2,000 to cost of conventional instruments.

260. VERVALIN, CHARLES H. Bigger Refineries Are On The Way. Petrol. Refiner, vol. 38, No. 10, October 1959, pp. 200, 203.

Bigger refineries are more economical. Larger plants achieve normal reduction in capital and operating cost per barrel of throughput which comes from increased size. Enclosed table shows that capital cost of refinery on throughput basis decreases by about 0.6 power of total capacity.

W

261. WEAVER, JAMES B. Ambiguity in the Investment Base. Ind. Eng. Chem., vol. 51, No. 10, October 1959, pp. 61A-62A.

Usual systems for performance appraisal or for judging investment success require a valuation of existing investment which is very difficult. Points up the problem.

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262. WEAVER, JAMES B. Chemical Cost and Profitability Estimation--1958 Annual Review. Ind. Eng. Chem., vol. 51, No. 5, May 1959, pp. 689-696.

Third in series of annual reviews on chemical engineering economics. Includes discussion of effect of inflation, costs and sources of capital, evaluation of research by estimation, and engineering economy and operations research.

263. _____. Sunk Costs, Incremental Costs, and Cash Flow. Ind. Eng. Chem., vol. 51, No. 12, December 1959, pp. 67A-68A.

Discusses irrelevance of fixed and sunk costs to decision; clarifies importance of incremental concept and cash flow.

264. _____, AND LYNDALL, FRANK S. A Cash-Flow Definition of Working Capital. Ind. Eng. Chem., vol. 51, No. 8, August 1959, pp. 49A-51A.

Accounting definition contrasted with economic evaluation definition; time study of cash flows in single sale.

265. _____. The Elements of Working Capital. Ind. Eng. Chem., vol. 51, No. 6, June 1959, pp. 67A-68A.

Inventories, accounts receivable, accounts payable, taxes payable, and cash--all by a cash-flow definition.

266. WEAVER, JAMES B., AND STAUDT, W. E. Appreciating Depreciation. Ind. Eng. Chem., vol. 51, No. 2, February 1959, pp. 65A-67A.

The various methods for calculating depreciation are discussed and typical examples are shown.

267. WEAVER, PAUL E. Does Your Sandblasting Cost Too Much? Petrol. Refiner, vol. 38, No. 6, June 1959, pp. 217-220.

Sandblasting can be unnecessarily costly if expensive and inefficient materials and equipment are used. Factors for efficient sandblasting are presented. Cost information taken from various sandblasting operations is presented backing argument that wrong sand, nozzle, air supply, and sandblaster will cost you about ten times more for the job than it should cost.

268. WEST, J. M., AND ROY, G. M. The Future of Boiling-Water Reactors. Nucleonics, vol. 17, No. 1, January 1959, pp. 42-49.

West and Roy present estimates for performance and costs of boiling-reactor plants that could be built today, based on latest EBWR (Experiment Boiling-Water Reactor) experience.

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269. WEST, L. H. Rectifiers Protect Bare Pipeline. Oil Gas Jour., vol. 57, No. 6, Feb. 2, 1959, pp. 80-84.

Cathodic protection of 206 miles of bare pipe is expected to save about $1,000,000 over and above initial investment and operating expense in first 5 years. These calculations are based on projection of leak-expectancy curves. Rectifiers appear better, from practical standpoint, than galvanic anodes for use in cathodic-protection system. The average total cost for single rectifier installation in 1957 program is $2,400. Breakdown of involved items in typical units is shown.

270. WEST, R. F., AND YUAN, L. W. Process Evaluation...Technical and Economic Factors in Profitable Process Development. Chem. Eng. Prog., vol. 55, No. 9, September 1959, pp. 35-37.

Sources of data, evaluation, and presentation of results are discussed for process evaluation. Mentions payout time as most common yardstick.

271. WILLIAMS, A. WYN. Automatic Anthracite Wins Preference. Coal Utilization, vol. 13, No. 3, March 1959, pp. 31-33.

Explains why the Moses Taylor Hospital, Scranton, Pennsylvania, chose automatic anthracite over other fuels to modernize their steam plant. A table containing comparative annual operating costs is included.

272. WILSON, W. B., AND LANDES, I. H. How to Select Your Drive System. Oil Gas Jour., vol. 57, No. 51, Dec. 14, 1959, pp. 76-79.

Presents actual case studies illustrating some of the considerations for selection of drive systems. Steam and power requirements for refinery or chemical-plant steam and power-system study are included showing the following: (1) Costs for electric-motor drive and all-electric power puchased; (2) costs for combination of steam turbines and motor drives; and (3) costs for gas turbine and steam-turbine drive.

273. WORLD OIL. The Cost-Price Squeeze and What Can Be Done About It. Vol. 149, No. 6, November 1959, pp. 93-110.

Special cost-price report which includes: (1) Condensation of five major economic studies; (2) reasons for cost-price squeeze; (3) technological developments that would help cut costs; and (4) how one company determines cost. Report shows excessive productive capacity, oversupply, and rising costs.

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274. WORLD OIL. Why the Oil Industry Needs a Depletion Provision. Vol. 149, No. 1, July 1959, p. 120.

Reviews joint survey conducted by American Petroleum Institute, Independent Petroleum Association of America, and Mid-Continent Oil and Gas Association providing authoritive cost data for drilling and equipping oil and gas wells and dry holes in United States.

Y

275. YOUNG, A. RUSSELL. Liquid Methane...A Cheaper Means of Peak Shaving? Oil Gas Jour., vol. 57, No. 13, Mar. 23, 1959, pp. 75-82.

Presents investment and operating cost data developed from large-scale natural-gas liquefaction plant. These data prove out economical designs for future liquefaction plants.

276. YOUNGBLUT, K. C. Hot First Electrostatic Desulfurizer Has Performed for Cities Service. Oil Gas Jour., vol. 57, No. 35, Aug. 24, 1959, pp. 78-80.

Cost of producing commercial electrostatic desulfurizer representing an attempt to desulfurize catalytic reformer feedstock with sulfuric acid is about $350,000. Spent alkylation acid is used as primary treating agent. Operating costs are nominal principally due to utilization of this treating agent.

Z

277. ZABEL, HERMAN W., AND MARCHITTO, MICHAEL. What Price Can I Get for My Chemicals? Chem. Eng., vol. 66, No. 21, Oct. 19, 1959, p. 112.

Exclusion charts relate price and volume. Data given for constructing exclusion charts for various types of chemical products.

278. ZIMMERMAN, O. T., AND LAVINE, IRVIN. Ball, Pebble, and Rod Mill Installations. Cost Eng., vol. 4, No. 4, October 1959, pp. 4-16.

Rotating drum mill--most widely used grinding medium--may be either batch or continuous in operation and can be divided into four general classifications as follows: (1) Ball mills; (2) pebble mills; (3) rod mills; and (4) tube mills. Equipment costs, power costs, operating labor costs, maintenance costs, and space costs are included for grinding installation.

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279. **ZIMMERMAN, O. T., AND LAVINE, IRVIN.** Non-Powered Industrial Trucks and Related Equipment. Cost Eng., vol. 4, No. 1, January 1959, pp. 4-15.

Gives costs of non-powered industrial trucks and related equipment. Trucks are used for handling materials in many industrial plants.

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